Oracle® Multimedia

User's Guide

12*c* Release 1 (12.1)

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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 1 (12.1)

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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 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*
- *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 Reference*

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

For information about using the Oracle Multimedia JSP Tag Library, see *Oracle Multimedia JSP Tag Library Guide* on the Oracle Multimedia Web page of the Oracle Technology Network Web site.

For more information about Java, including information about Java Advanced Imaging (JAI), 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 Multimedia 12*c* Release 1 (12.1)

The following are changes in *Oracle Multimedia User's Guide* for Oracle Database 12*c* Release 1 (12.1).

New Features

The following features are new in this release:

- Oracle Multimedia Support for the DICOM Protocol in Oracle Database

  See *Oracle Multimedia DICOM Developer's Guide*.
- Oracle Multimedia Support for DICOM Content in Oracle WebCenter Content

  See *Oracle Multimedia DICOM Developer's Guide*.
- Oracle Multimedia Support for Full Mode Database Export and Import

  See:
  - *Oracle Multimedia DICOM Developer's Guide*
  - *Oracle Database Utilities*
- Support for Oracle Multimedia in CDBs

  See:
  - *Oracle Multimedia DICOM Developer's Guide*
  - *Oracle Database Concepts*
  - *Oracle Database Administrator's Guide*
- Oracle Multimedia Support in Rolling Upgrade

  See:
  - *Oracle Multimedia DICOM Developer's Guide*
  - *Oracle Database Upgrade Guide*
  - *Oracle Data Guard Concepts and Administration*

The following sections summarize these new features.

Oracle Multimedia Support for the DICOM Protocol in Oracle Database

Oracle Multimedia now supports the DICOM communication protocol, the universally accepted standard for exchanging DICOM images over computer networks. This feature enables the use of this protocol to store and access DICOM content from Oracle Database.

Oracle Multimedia Support for DICOM Content in Oracle WebCenter Content

Oracle Multimedia DICOM support has been integrated into Oracle WebCenter Content. With this support, Oracle WebCenter Content can now be used to store and manage DICOM content. This feature includes:

- A DICOM protocol adapter that supports access to Oracle WebCenter Content DICOM data sources and DICOM viewers
- A DICOM WebCenter Content component that extracts DICOM metadata into the WebCenter Content store, generates thumbnail images, and converts images to Web-compatible formats
- Support for accessing DICOM content in its original repository, and for transferring DICOM content into Oracle WebCenter Content

Oracle Multimedia Support for Full Mode Database Export and Import

Full database export and full database import using the Oracle Data Pump utilities are now supported for Oracle Multimedia.

Support for Oracle Multimedia in CDBs

A multitenant container database (CDB) is a single physical database that contains 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 a PDB. Oracle Multimedia is supported in both CDB and non-CDB architectures.

Oracle Multimedia Support in Rolling Upgrade

Support is provided for the Oracle Multimedia data types in the context of transient logical standby rolling upgrade.

DICOM data model changes are not supported during a rolling upgrade.

Deprecated Features

The following feature is deprecated in this release, and may be desupported in a future release:

- ORDImage Support for DICOM

  See *Oracle Multimedia Reference* for information about alternatives.

The following section summarizes this deprecated feature.

ORDImage Support for DICOM

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

Oracle recommends writing new medical imaging applications to use the DICOM support that was introduced in Oracle Database 11*g* Release 1 (11.1). This support is documented in *Oracle Multimedia DICOM Developer's Guide*.

Oracle also recommends migrating existing applications from the DICOM support in ORDImage objects to the DICOM support that was introduced in Oracle Database 11*g* Release 1 (11.1). This process is described in *Oracle Multimedia DICOM Developer's Guide*.

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Introduction to Oracle Multimedia

Oracle Multimedia (formerly Oracle *inter*Media) 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.
- Audio and video services for the storage, retrieval, and metadata extraction of popular audio and video file formats.
- Media content services to Oracle JDeveloper and Oracle partners.

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, and by supporting Web technologies for multimedia data.

The Oracle Multimedia architecture defines the framework (see Figure 1–1) 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.

Figure 1–1 illustrates the Oracle Multimedia architecture from a three-tier perspective:

1. Database tier (Oracle Database)
2. Middle tier (Oracle Fusion Middleware)
3. Client tier (Thin Client and Thick Clients)

In the database tier, using Oracle Multimedia, Oracle Database holds rich content in tables along with traditional data. Through a database-embedded JVM, a server-side media parser and an image processor are supported. The media parser has object-oriented and relational interfaces, supports format and application metadata parsing, and can be extended to support additional formats. The image processor includes JAI. It also provides image processing for operations such as producing thumbnail-size images, converting image formats, and image watermarking.

Using Oracle Multimedia methods, import and export operations between the database and operating system files (external file storage) are possible. Oracle Multimedia also supports special delivery types of servers, such as streaming content from a database. Using the Oracle Multimedia Plug-ins for RealNetworks or Windows Media Services, the Helix Universal Server or Windows Media Streaming Server can stream multimedia data to a client directly out of the database using Real-Time Streaming Protocol (RTSP). In addition, third-party media processors such as speech recognition engines can run external to the database to process media stored in the database and return results to the database.

Using Oracle Multimedia in the database tier 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.

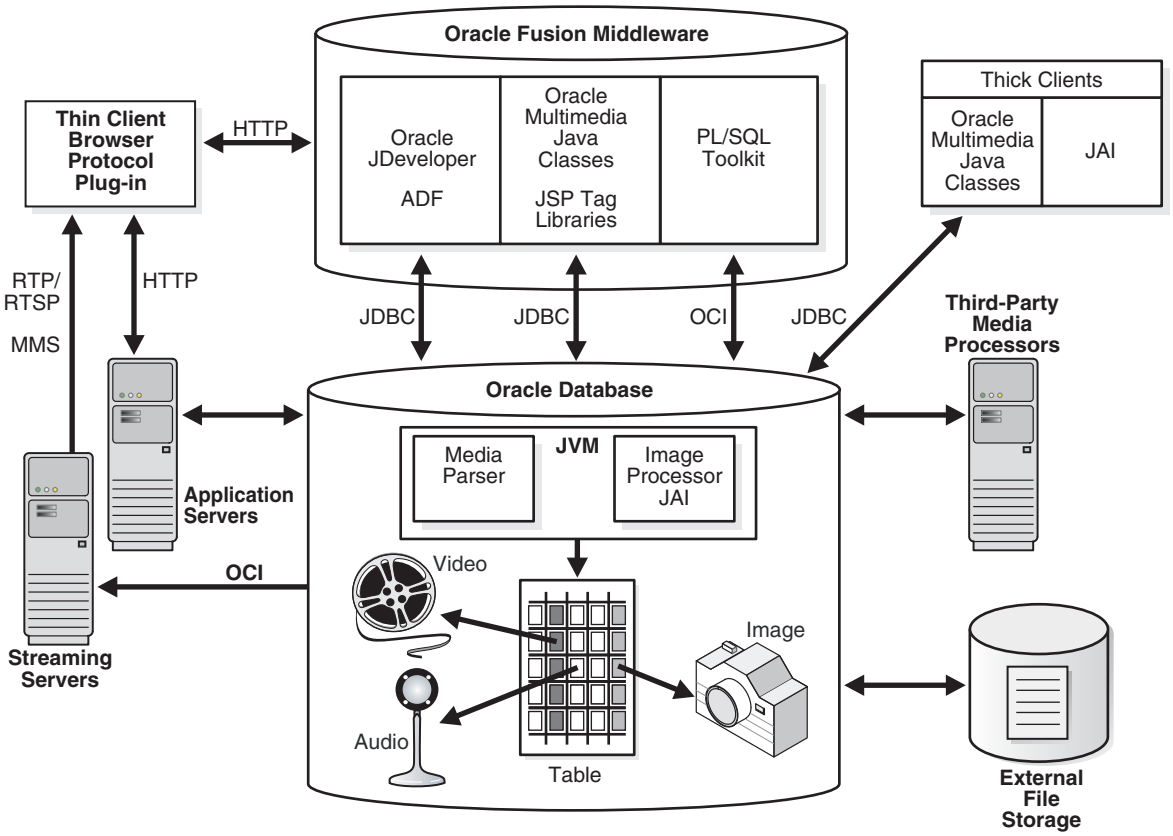
In the middle tier, Oracle Fusion Middleware provides access to Oracle Multimedia through Oracle Multimedia Java classes, which enable Java applications on any tier (client, application server, or database) to access, manipulate, and modify audio, image, and video data stored in a database. In addition, Oracle Multimedia Java classes facilitate the upload and retrieval of multimedia data stored in a database using the Oracle Multimedia OrdAudio, OrdDoc, OrdImage, and OrdVideo object types. And, Oracle Multimedia Java classes can access data stored in the Oracle Multimedia objects or BLOBs or BFILEs directly.

Developers can also use Oracle JDeveloper and Oracle Multimedia to build media-rich Java applications quickly and easily using the Oracle Multimedia/ADF Business Components integration package.

SQL developers familiar with the database can develop Web applications that use Oracle Fusion Middleware exclusively, and Oracle Database using the PL/SQL development environment. The steps include using the PL/SQL Gateway (mod_plsql) feature of the Oracle HTTP Server and the PL/SQL Web Toolkit. Web application developers can write PL/SQL servlets and PL/SQL server pages (PSP) that invoke PL/SQL procedures stored in the database through an Oracle Net connection and OCI.

In the client tier, the ability to perform local processing is supported through Oracle Multimedia Java classes and Java Advanced Imaging (JAI). Oracle Multimedia Java classes supply direct access to all media types from the client. JAI provides a set of APIs for media processing on the client.

Figure 1–1 Oracle Multimedia Architecture



See Also:

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

Oracle Multimedia features available only on Oracle Technology Network (OTN) include the following:

- Oracle Multimedia Plug-in for RealNetworks Streaming Servers (see Section 1.10.2)

- Oracle Multimedia Plug-in for Microsoft Windows Media Services (see Section 1.10.2)

1.2 Object Relational Technology

Oracle Database is an object relational database management system. Thus, in addition to its traditional role in the safe and efficient management of relational data, Oracle Database provides support for the definition of object types, including the data associated with objects and the operations (methods) that can be performed on them.

Object relational technology includes integral support for BLOBs to provide the basis for adding complex objects to databases. 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 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 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 object types support 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.

Oracle Multimedia is accessible to applications through both relational and object interfaces. 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 uses object types, similar to Java or C++ classes, to describe multimedia data. These object types are called ORDAudio, ORDDoc, ORDImage, and ORDVideo. An instance of these 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 objects have a common media data storage model. The media data component of these objects can be stored in the database, in a BLOB under transaction control. The media data can also be stored outside 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. Section 1.8 describes several ways of loading multimedia data into a database.

Media metadata is stored in the database under Oracle Multimedia control. Whether media data is stored within or outside the database, Oracle Multimedia manages metadata for all the media types and might automatically extract it for audio, image, and video. This 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 methods, a minimal set of image manipulation 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 extensible. It supports a base set of popular audio, image, and video data formats for multimedia processing that also can be extended, for example, to support additional formats, new digital compression and decompression schemes (**codecs**), data sources, and even specialized data processing algorithms for audio and video data. See Chapter 7 for more information about extending Oracle Multimedia.

Oracle Multimedia is a building block for various multimedia applications, rather than an end-user application. It consists of 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) introduces 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.

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 ORDAudio object type to build audio applications or specialized ORDAudio objects, in these subsections:

- Digitized Audio
- Audio Components

1.4.1 Digitized Audio

ORDAudio integrates the storage, retrieval, and management of digitized **audio data** 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. ORDAudio can store and

retrieve audio data of any supported data format. ORDAudio can automatically extract metadata from audio data of a variety of popular audio formats. ORDAudio can also extract application attributes and store them in the comments field of the object in XML form. ORDAudio is extensible and can be made to recognize and support additional audio formats.

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

1.5 ORDDoc or Heterogeneous Media Data Concepts

This section contains information about **heterogeneous media data** concepts, and information about using the ORDDoc object type to build applications or specialized ORDDoc objects, in these subsections:

- Digitized Heterogeneous Media Data
- Heterogeneous Media Data Components

1.5.1 Digitized Heterogeneous Media Data

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

The ORDDoc type can store any heterogeneous media data including audio, image, and video data in a database column. Instead of having separate columns for audio, image, text, and video objects, you can use one column of ORDDoc objects 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 ORDDoc type 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 ORDImage object type to build image applications or specialized ORDImage objects, in these subsections:

1.6.1 Digitized Images

ORDImage integrates the storage, retrieval, and management of digitized images in a database.

ORDImage 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 ORDImage can process, extract, and store attributes and other image features

1.6.3 Metadata in Images

Oracle Database provides an image metadata feature in Oracle Multimedia. The metadata feature enhances the behavior of the Oracle Multimedia ORDImage object type by adding 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. Metadata can be stored in a database, indexed, searched, and made available to applications using the standard mechanisms of Oracle Database. See Chapter 6 for more information about the image metadata feature.

1.6.4 Medical Imaging

Oracle Database includes medical imaging format and protocol support by providing these features in Oracle Multimedia DICOM:

- Storage and retrieval of medical imaging data in the database to synchronize the DICOM data with the associated business data
- Full object and relational 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 content and format metadata from media sources (audio and video files), and collects and organizes this metadata as an XML formatted CLOB. Once metadata has been extracted and stored, you can index the metadata for powerful full text and thematic media searches using Oracle Text. Thus, the database can be queried to locate the media data based on the metadata extracted from the media.

See Also:

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

1.6.6 Image Processing

Oracle Multimedia supports image processing, such as 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

1.6.7 SQL/MM Still Image Standard Support

Oracle Multimedia also provides support for the first edition of the ISO/IEC 13249-5:2001 SQL MM Part5:StillImage standard (commonly referred to as the SQL/MM Still Image standard), which includes these object relational types for image characteristics: SI_StillImage, SI_AverageColor, SI_Color, SI_ColorHistogram, SI_FeatureList, SI_PositionalColor, and SI_Texture.

The following ORDImage features are not specified by the SQL/MM Still Image Standard, and therefore are not available for StillImage objects:

- Storing image data outside the database
- Image processing operations (such as scaling up, compressing, and so on) that are specific to ORDImage
- Java client API

See Also:

Oracle Multimedia Reference for more information about the SQL/MM Still Image Standard object types

1.7 Video Concepts

This section contains information about digitized video concepts, and information about using ORDVideo to build video applications or specialized ORDVideo objects, in these subsections:

- Digitized Video
- Video Components

1.7.1 Digitized Video

ORDVideo integrates the storage, retrieval, and management of digitized **video data** 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. ORDVideo can store and retrieve video data of any supported data format. ORDVideo 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 ORDVideo 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 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 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 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 can be stored in Oracle Multimedia object types, or directly in BLOBs or BFILEs. You can realize the most benefit by storing media in Oracle Multimedia object types. However, many of the features of Oracle Multimedia are available to media stored in BLOBs and BFILEs using the relational interface.

The Oracle Multimedia relational interface lets developers use static methods of Oracle Multimedia object types with existing and new media stored in BLOBs and BFILEs. Specifically, developers can move media 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 this relational interface. Oracle Multimedia static methods 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
- Querying Multimedia Data

See Also:

- *Oracle Multimedia Reference* for more information about the Oracle Multimedia relational interface
- *Oracle Multimedia Reference* for more information about the ORDSource object type

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 to perform these 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, by other relational table columns, and by content, such as image content-based retrieval.

1.10 Accessing Multimedia Data

Applications access and manipulate multimedia data using SQL, PL/SQL, OCI, or Java through the object relational types OrdAudio, OrdDoc, OrdImage, and OrdVideo.

The following subsections describe ways in which applications, Oracle development tools, and third-party development tools can access multimedia data stored in the database using Oracle Multimedia object types:

- Oracle Multimedia Java API
- Streaming Content from Oracle Database
- Support for Web Technologies
- Oracle Multimedia Support for Java Advanced Imaging (JAI)

1.10.1 Oracle Multimedia Java API

Oracle Multimedia Java API enables Java applications 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. Oracle Multimedia Java API makes it possible for Java database connectivity (JDBC) result sets to include both traditional relational data and Oracle Multimedia media objects. This support enables applications to easily select and operate on a result set that contains sets of Oracle Multimedia columns plus other relational data. These classes also enable access to object attributes and invocation of object methods.

See Also:

Oracle Multimedia Java API Reference for more information about this Java API

1.10.2 Streaming Content from Oracle Database

You can stream audio and video content stored in Oracle Database using an Oracle Multimedia plug-in that supports a third-party streaming server, and deliver this content for play on a client that uses the browser-supported streaming player. Oracle Multimedia provides two plug-ins to stream content from Oracle Database: Oracle Multimedia Plug-in for RealNetworks Streaming Servers and Oracle Multimedia Plug-in for Windows Media Services.

To download these plug-ins, see *Oracle Multimedia* on the Oracle Technology Network Web site.

Oracle Multimedia Plug-in for RealNetworks Streaming Servers

Oracle Multimedia Plug-in for RealNetworks Streaming Servers is a data source plug-in that enables RealNetworks servers to stream media data directly from Oracle Database to a media player client. The plug-in is installed with RealNetworks

Streaming Server, and configured and managed using the administration tool of the streaming server. See *Oracle Multimedia Plug-in for RealNetworks Streaming Servers Readme* for more information.

See Also:

`http://www.realnetworks.com/` for more information about streaming servers from RealNetworks

Oracle Multimedia Plug-in for Microsoft Windows Media Services

Oracle Multimedia Plug-in for Microsoft Windows Media Services enables Microsoft Windows Media servers to stream multimedia content to a client directly from Oracle Database. This package also includes a Plug-in Property Page that can be accessed from the Windows Media Services Administrative interfaces. The Plug-in Property Page enables users to inspect, define, and edit the Plug-in mount points that map to media content in Oracle Database. The Plug-in mount points are used to configure the source URL of a server publishing point, from which a Microsoft Windows Media Player client requests media content stored in Oracle Database. See *Oracle Multimedia Plug-in for Microsoft Windows Media Services Readme* for more information.

1.10.3 Support for Web Technologies

Using Oracle Multimedia support for Web technologies, you can easily integrate multimedia data into Web and Java applications. You can also store, retrieve, and manage rich media content in a database.

Oracle Multimedia Servlets and JSP Java API

Oracle Multimedia Servlets and JSP Java API facilitates the upload and retrieval of multimedia data stored in a database using the Oracle Multimedia OrdAudio, OrdDoc, OrdImage, and OrdVideo object types. Oracle Multimedia Servlets and JSP Java API uses Oracle Multimedia Java API to access data stored in the Oracle Multimedia object types. However, Oracle Multimedia Servlets and JSP Java API can also be used to handle upload and retrieval of data using BLOBs directly.

The `OrdHttpResponseHandler` class facilitates the retrieval of multimedia data from a database and its delivery to a browser or other HTTP client from **Java servlets**. The `OrdHttpJspResponseHandler` class provides the same features for **JavaServer Pages (JSP)**.

Note: JSP engines are not required to support access to the servlet binary output stream. Therefore, not all JSP engines support the delivery of multimedia data using the `OrdHttpJspResponseHandler` class.

Form-based file uploading using HTML forms encodes form data and uploaded files in Post requests using the multipart/form-data format. The `OrdHttpUploadFormData` class facilitates the processing of such requests by parsing the Post data and making the contents of regular form fields and the contents of uploaded files readily accessible to a Java servlet or JSP. The handling of uploaded files is facilitated by the `OrdHttpUploadFile` class, which provides an easy-to-use API that applications call to load audio, image, and video data, or heterogeneous media data into a database.

See Also:

Oracle Multimedia Servlets and JSP Java API Reference for more information about this Java API

Integration with Oracle Application Development Framework Business Components

For rapid development of media-rich Web applications, Oracle offers developers a Java integrated development environment (IDE), Oracle JDeveloper, that maximizes developer productivity. Oracle JDeveloper enables developers to build multitier, component-based Internet applications in Java that use Oracle Multimedia features to create visually attractive applications. Oracle Application Development Framework Business Components (ADF Business Components) is the component of JDeveloper that provides a set of intelligent software building blocks to manage common facilities. An Oracle Multimedia/ADF Business Components integration package includes media-specific domain classes and a set of utility classes. The domain classes are wrappers of the classes of Oracle Multimedia Java API, and inherit all the underlying multimedia retrieval, upload, and manipulation methods. The domain classes support the ADF Business Components APIs, and provide built-in integrated multimedia capabilities. The utility classes support the retrieval, rendering, and uploading of multimedia content. Together, they provide a fully featured, integrated application development environment that enables developers to create a wide variety of media-rich applications.

1.10.4 Oracle Multimedia Support for Java Advanced Imaging (JAI)

Oracle Multimedia Java API describes three types of stream objects, which provide interfaces to BLOB and BFILE data that can be used by Java Advanced Imaging (JAI). These Java classes enable a JAI application to read and write image data stored in a database using Oracle Multimedia OrdImage objects, or in BLOBs or BFILEs.

See Also:

- *Oracle Multimedia Java API Reference* for more information about the Java classes for JAI stream objects provided by Oracle Multimedia
- `http://www.oracle.com/technetwork/java/index.html` for more information about Java Advanced Imaging (JAI)

1.11 Extending Oracle Multimedia

Oracle Multimedia can be extended to support:

- Other external sources of media data not currently supported (other than BLOB, BFILE, or URL)
- Other media data formats not currently supported

> **Note:** Oracle Multimedia can store any format. However, it can only extract metadata and process (image only) media data for formats that are supported or known to Oracle Multimedia.

- Audio and video data processing

See Chapter 7 for more information about extending Oracle Multimedia.

See Also:

- *Oracle Multimedia Reference* for a list of supported formats for audio data
- *Oracle Multimedia Reference* for a list of supported formats for image data
- *Oracle Multimedia Reference* for a list of supported formats for video data

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.

Using a complete development framework supported by class library interfaces, 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.

Using either the object type interface or the relational interface, Oracle Multimedia provides Internet support for Oracle Fusion Middleware and Oracle Database and authoring tools so you can quickly develop Web-based applications to upload to the database, retrieve from it, and manipulate multimedia data for delivery to Web browsers.

This chapter includes these sections:

See these chapters for more sample applications:

Chapter	Sample Application
Chapter 3	Describes the Oracle Multimedia Photo Album sample Web application, which is implemented using PL/SQL, Java servlets, and JavaServer Pages (JSP). This sample application demonstrates how to apply the steps described in Section 2.3 and Section 2.5 in a real Web application to upload and retrieve media data stored in a database.
Chapter 4	Describes 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.

Chapter	Sample Application
Chapter 5	Describes the Oracle Multimedia Java API sample application, which is implemented using Java, JDBC, and Oracle Multimedia Java classes. This sample application demonstrates how to apply the steps described in Section 2.4 in a real Java application to upload and retrieve media data stored in a database.

2.1 Overview of the Application Development Environment

Oracle Multimedia supports application development by providing these tools and capabilities, which are briefly described in the following subsections:

- Java Class Libraries and Other Packages and Interfaces
- Integration With PL/SQL Gateway and PL/SQL Web Toolkit
- Integration With Components in Other Oracle Development Tools
- Integration With Third-Party Streaming Media Servers

2.1.1 Java Class Libraries and Other Packages and Interfaces

Oracle Multimedia provides several Java class libraries that enable access (insert, update, and retrieve) and manipulation (process) of multimedia data stored in the database. Oracle Multimedia also provides specialized Java class libraries.

Table 2–1 lists the Java application programming interfaces that are available for Oracle Multimedia, and points to additional information.

Table 2–1 Java APIs for Oracle Multimedia

Name of Java API Class Library	More Information
Oracle Multimedia Java API	*Oracle Multimedia Java API Reference*
Java Advanced Imaging (JAI) classes **Note:** These classes are included in the Oracle Multimedia Java API class library.	*Oracle Multimedia Java API Reference*
Oracle Multimedia Servlets and JSP Java API	*Oracle Multimedia Servlets and JSP Java API Reference*
Oracle Multimedia JSP Tag Library	*Oracle Multimedia JSP Tag Library Guide*
Oracle Multimedia DICOM Java API	*Oracle Multimedia DICOM Java API Reference*
Oracle Multimedia Mid-Tier Java API	*Oracle Multimedia Mid-Tier Java API Reference*

Oracle Multimedia also integrates with the Oracle Multimedia/Oracle Application Development Framework Business Components (ADF Business Components) integration package, and with C++ and traditional 3GLs through modern class library interfaces. Class libraries provide access to multimedia data stored in the database in several ways.

See Also:

- *Oracle Database JDBC Developer's Guide* for more information about using JDBC
- `http://www.oracle.com/technetwork/java/index.html` for more information about Java Advanced Imaging (JAI)
- *Oracle Multimedia DICOM Developer's Guide* for more information about Oracle Multimedia DICOM features and enhancements
- *Oracle Database 2 Day + Java Developer's Guide* for more information about Oracle JDeveloper and ADF Business Components

The following subsections briefly describe each of these components.

Oracle Multimedia Java API Class Library

Using the Java database connectivity (JDBC) interface, the Oracle Multimedia Java API class library enables you to use Java proxy classes for Oracle Multimedia database objects 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. Oracle Multimedia Java API makes it possible for JDBC result sets to include both traditional relational data and Oracle Multimedia columns of object type media data, to easily select and operate on the result set, to access object attributes, and to invoke object methods. Section 1.10.1 for general information, and Section 2.4 for a description of how to use Java and JDBC to develop media-rich Java client applications using this Java class library.

Java Advanced Imaging Classes

The Oracle Multimedia Java API class library includes several Java Advanced Imaging (JAI) classes. The Oracle Multimedia Java API describes three types of stream objects, which provide interfaces to BLOB and BFILE data, that can be used by JAI. These classes enable a JAI application to read and write image data stored in a database using Oracle Multimedia OrdImage objects, or in BLOBs or BFILEs. See Section 1.10.4 for general information.

Oracle Multimedia Servlets and JSP Java API Class Library

The Oracle Multimedia Servlets and JSP Java API class library supports Web technologies, enabling you to quickly develop Java applications using Java servlets and JavaServer Pages (JSP). See Section 1.10.3 for general information. Section 2.5 describes how to develop media-rich Java-based Web applications using this Java class library. Section 3.2 includes an example of a Java servlet application, and Section 3.3 includes an example of a JSP application.

Oracle Multimedia JSP Tag Library

The Oracle Multimedia JSP Tag Library is an extension of the Oracle Multimedia Servlets and JSP Java API class library. This Java class library provides JSP tags that simplify retrieving and uploading media data from and to Oracle Database in multimedia JSP Web applications.

Oracle Multimedia DICOM Java API Class Library

Oracle Multimedia DICOM Java API is a specialized class library that enables users to write Java applications using the Oracle Multimedia object designed to store Digital

Imaging and Communications in Medicine (DICOM) data. See Section 1.6.4 for general information.

Oracle Multimedia Mid-Tier Java API Class Library

Oracle Multimedia Mid-Tier Java API is a specialized class library that enables users to write Java applications for extracting DICOM metadata outside of Oracle Database before the data is loaded into the database.

Oracle Multimedia/Oracle Application Development Framework Business Components Integration Package

The Oracle Multimedia/Oracle Application Development Framework Business Components (ADF Business Components) integration package includes the Oracle Multimedia domain classes and a set of utilities for use with Oracle JDeveloper. Oracle JDeveloper is a Java-integrated development environment (IDE) tool that supports the application framework (ADF Business Components), enabling you to build multitier, component-based Internet applications. See Section 1.10.3 for general information.

2.1.2 Integration With PL/SQL Gateway and PL/SQL Web Toolkit

Oracle Multimedia uses the PL/SQL Gateway (mod_plsql) feature of the Oracle HTTP Server and the PL/SQL Web Toolkit features of Oracle Fusion Middleware and Oracle Database to listen for browser requests, to execute stored PL/SQL procedures in the database using Oracle Net and Oracle Call Interface (OCI), and to generate an HTML page containing data and code for the response returned to the Web browser for display. As a Web application developer, you can write PL/SQL servlets and PL/SQL server pages (PSP) that invoke PL/SQL procedures stored in the database through an Oracle Net connection and OCI. See Section 2.3 for a description of how to use PL/SQL Gateway and PL/SQL Web Toolkit to develop PL/SQL Web applications. See Section 3.1 for an example of an application that uses the PL/SQL Gateway and PL/SQL Web Toolkit for Oracle Fusion Middleware and Oracle Database.

See Also:

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

2.1.3 Integration With Components in Other Oracle Development Tools

Oracle Multimedia integrates Oracle development tools with tightly integrated components to enable you to quickly and easily develop applications that provide access to (insert, update, and retrieve) and manipulation (process) of multimedia data stored in the database for delivery to Web browsers and client applications. These development tools include:

- Oracle JDeveloper
- Oracle Designer

Oracle JDeveloper

Oracle JDeveloper is an IDE tool, which is written 100% in Java, that supports the application framework (Oracle Application Development Framework Business Components). An Oracle Multimedia/ADF Business Components integration package includes the Oracle Multimedia domain classes and a set of utilities. The domain classes are wrappers of Oracle Multimedia Java API and inherit all the underlying multimedia retrieval, upload, and manipulation methods. The domain classes support the ADF Business Components APIs and provide built-in integrated multimedia

capabilities, while the utility classes support the retrieval, rendering, and uploading of multimedia content. See Section 1.10.3 for general information.

See Also:

Oracle Fusion Middleware Extension SDK Reference for Oracle JDeveloper in the Oracle Fusion Middleware Online Documentation Library for more information about this tool

Oracle Designer

Oracle Designer is a tool used to manage software configuration management for controlling the evolution of an application from identification of components, through initiation, evaluation, authorization, development, and implementation. Oracle Designer can generate C++ classes that enable applications running on the client, on Oracle Fusion Middleware, or on Oracle Database to call Oracle Multimedia methods.

2.1.4 Integration With Third-Party Streaming Media Servers

Oracle Multimedia integrates with third-party streaming media servers to enable dynamic and direct delivery of multimedia data stored in the database to a media player client. These third-party streaming servers include:

- Oracle Multimedia Plug-in for RealNetworks Server
- Oracle Multimedia Plug-in for Microsoft Windows Media Services

You can download these plug-ins from *Oracle Multimedia* on the Oracle Technology Network Web site.

Oracle Multimedia Plug-in for RealNetworks Server

Oracle Multimedia Plug-in for RealNetworks Server is a data source plug-in that enables a RealNetworks server to stream media data directly from Oracle Database to a media player client. The plug-in is installed with RealNetworks Server, and configured and managed using the administration tool of the streaming server. See *Oracle Multimedia Plug-in for RealNetworks Streaming Servers Readme*.

See Also:

`http://www.realnetworks.com/` for more information about streaming servers from RealNetworks

Oracle Multimedia Plug-in for Microsoft Windows Media Services

Oracle Multimedia Plug-in for Microsoft Windows Media Services enables Microsoft Windows Media servers to stream multimedia content to a client directly from Oracle Database. This plug-in is installed on Windows 2003 Server, and configured with Windows Media Services. See *Oracle Multimedia Plug-in for Microsoft Windows Media Services Readme*.

2.2 Developing PL/SQL Client Applications Using the PL/SQL API

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
- ORDDoc
- ORDImage
- ORDVideo

The examples in this section use the sample schemas, which may be installed when you install Oracle.

The following subsections describe how to use various components of the PL/SQL development environment:

- Setting Up Your Environment for PL/SQL
- Media Query in PL/SQL
- Media Download in PL/SQL
- Media Upload in PL/SQL
- Handling Oracle Multimedia Exceptions in PL/SQL

See Also:

- *Oracle Multimedia Reference* for details about the Oracle Multimedia object types and available methods in the PL/SQL API
- *Oracle Database Sample Schemas* for information about how the sample schemas were created and how you can use them

2.2.1 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;
```

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 Chapter 7).
- 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.

2.2.2 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, Example 2–2, and Example 2–3 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;
```

2.2.3 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;
/
```

2.2.4 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 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.
  img.import(ctx);
  -- ORDImage.import also calls ORDImage.setProperties.

  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;
/
```

2.2.5 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 Chapter 3 and Chapter 4.

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 examples in this section describe exception handling in the Oracle Multimedia PL/SQL Web Toolkit Photo Album sample application.

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

See Also:

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

2.2.5.1 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.

2.2.5.2 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.

2.3 Developing PL/SQL Web Applications

SQL developers who are familiar with the database can develop Web applications that exclusively use Oracle Fusion Middleware and Oracle Database using the PL/SQL development environment. With the PL/SQL development environment, developers can come quickly up to speed to develop PL/SQL-based Web applications.

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.

There are two ways of generating HTML output from PL/SQL:

- Using function calls to generate each HTML tag for output using the PL/SQL Web Toolkit package that is part of Oracle Fusion Middleware and Oracle Database and whose `owa` packages are loaded into a common schema so that all users can access it
- Embedding PL/SQL code in Web pages (PL/SQL server pages)

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 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 Oracle Multimedia object columns with an empty BLOB. Next, a SQL SELECT FOR UPDATE operation selects the object columns for update. Finally, a SQL UPDATE operation updates the media objects in their respective columns. Oracle Multimedia methods are called to perform these tasks:

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

Media retrieval operations involve these tasks:

- Retrieving the object from the database into a local object
- Checking the cache validity of the object based on its updated time versus that of the HTTP header time
- Determining where the media object 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

Oracle Multimedia methods are called to get the time that the media object was last updated, to determine if the media is stored locally in the database, in a BFILE, or at a URL location, to get the MIME type of the media object, and finally to retrieve the media data.

The following subsection describes how to use some Web components of the PL/SQL development environment:

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

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

Oracle Fusion Middleware and Oracle Database install Oracle HTTP Server powered by the Apache HTTP server that contains the PL/SQL Gateway to communicate directly with a client Web browser.

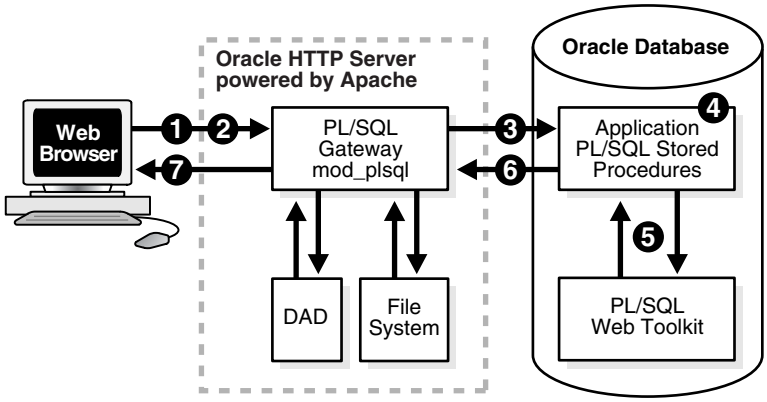
Oracle HTTP Server serves mainly the static HTML files, images, and so on, that a Web application uses, and is usually located in the file system where Oracle HTTP Server is installed. Oracle HTTP Server contains modules or plug-ins that extend its functions. One of these modules supplied by Oracle is 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 in the form of PL/SQL servlets or PL/SQL server pages 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 called `htp`, `htf`, and `owa` packages 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.

Figure 2–1 shows these main components of the PL/SQL development environment, Oracle HTTP Server (a component of Oracle Fusion Middleware and Oracle Database), the Web browser, and the database. The following information describes 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 called `htp`, `htf`, and `owa` packages that are used in the stored procedures to get information about the request, construct HTML tags, and return header information back 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.

Figure 2–1 Components of the PL/SQL Development Environment



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. This is how the PL/SQL application in the PL/SQL development environment is designed to work.

Web application developers who use the PL/SQL development environment, 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. To invoke these stored PL/SQL procedures, Web application developers use the request/response PL/SQL servlets and PL/SQL server pages (PSP) to enable Web browser clients to send requests and get back responses using HTTP.

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.

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]]
```

See Also:

Oracle Fusion Middleware User's Guide for mod_plsql in the Oracle Fusion Middleware Online Documentation Library for a detailed description of each parameter and the available options

To use the Oracle Multimedia Photo Album sample application and the PL/SQL Web Toolkit described in Section 3.1, the URL can be simplified to the format shown in Example 2–5.

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

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

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 to 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, 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 Chapter 4 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 Also:

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

2.4 Developing Java Client Applications Using JDBC

Developers who are familiar with Java and Java database connectivity (JDBC) can write media-rich Java applications using Oracle Multimedia Java API. The classes in Oracle Multimedia Java API are the Java proxy classes for Oracle Multimedia database objects. These Java classes provide access to Oracle Multimedia database objects through JDBC in a Java application.

The Java classes in Oracle Multimedia Java API are included in the `oracle.ord.im.*` package. These Java classes are named similarly to the Oracle Multimedia database objects, and in compliance with the standard Java naming convention:

- OrdAudio
- OrdDoc

- OrdImage
- OrdVideo

Developers who write medical imaging applications can use Oracle Multimedia DICOM Java API and Oracle Multimedia Mid-Tier Java API. In Oracle Multimedia DICOM Java API, the OrdDicom class provides access to Oracle Multimedia DICOM database objects in a Java application. The classes in Oracle Multimedia Mid-Tier Java API enable developers to write Java applications for extracting DICOM metadata outside of Oracle Database.

The examples in this section use the sample schemas, which may be installed when you install Oracle.

The following subsections describe how to use various components of the Java development environment with JDBC:

- Setting Up Your Environment for Java
- Media Retrieval in Java
- Media Upload in Java
- Handling Oracle Multimedia Exceptions in Java

See Also:

- *Oracle Multimedia Java API Reference* for details about the available classes and methods in this Java API
- *Oracle Multimedia DICOM Java API Reference* for details about the available classes and methods in this Java API
- *Oracle Multimedia Mid-Tier Java API Reference* for details about the available classes and methods in this Java API
- *Oracle Multimedia DICOM Developer's Guide* for more information about Oracle Multimedia DICOM features and enhancements
- *Oracle Database Sample Schemas* for information about how the sample schemas were created and how you can use them

2.4.1 Setting Up Your Environment for Java

Before you can begin using any of the Java APIs provided by Oracle Multimedia, 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, Table 2–2 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 2–2 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
	All Oracle Multimedia features	JDK 6 or later, on Linux and UNIX:
		`<ORACLE_HOME>/ord/jlib/ordim.jar`
		
		JDK 6 or later, on Windows:
		`<ORACLE_HOME>\ord\jlib\ordim.jar`

Name: `ojdbc6.jar`
 	
Description:
Oracle JDBC library
	All Oracle Multimedia features	JDK 6 or later, on Linux and UNIX:
		`<ORACLE_HOME>/jdbc/lib/ojdbc6.jar`
		
		JDK 6 or later, on Windows:
		`<ORACLE_HOME>\jdbc\lib\ojdbc6.jar`

Name: `xdb.jar`
 	
Description:
Oracle XDB Java classes library
	DICOM feature
	
	Oracle Multimedia metadata extraction
		JDK 6 or later, on Linux and UNIX:
		`<ORACLE_HOME>/rdbms/jlib/xdb.jar`
		
		JDK 6 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 6 or later, on Linux and UNIX:
		`<ORACLE_HOME>/lib/xmlparserv2.jar`
		
		JDK 6 or later, on Windows:
		`<ORACLE_HOME>\lib\xmlparserv2.jar`

Name: `orddcmmt.jar`
 	
Description:
Oracle Multimedia Mid-Tier Java classes
	Mid-Tier Java API feature	JDK 6 or later, on Linux and UNIX:
		`<ORACLE_HOME>/ord/jlib/orddcmmt.jar`
		
		JDK 6 or later, on Windows:
		`<ORACLE_HOME>\ord\jlib\orddcmmt.jar`

Name: `ordimdcm.jar`
 	
Description:
Oracle Multimedia DICOM Java library
	Mid-Tier Java API feature	JDK 6 or later, on Linux and UNIX:
		`<ORACLE_HOME>/ord/jlib/ordimdcm.jar`
		
		JDK 6 or later, on Windows:
		`<ORACLE_HOME>\ord\jlib\ordimdcm.jar`

Table 2–2 (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	DICOM feature	JDK 6 or later, on Linux and UNIX: *<ORACLE_HOME>*`/ord/jlib/orddicom.jar` JDK 6 or later, on Windows: *<ORACLE_HOME>*`\ord\jlib\orddicom.jar`
Name: `ordhttp.jar` Description: Oracle Multimedia Servlets and JSP Java HTTP classes	Java servlets and JavaServer Pages (JSP) applications	JDK 6 or later, on Linux and UNIX: *<ORACLE_HOME>*`/ord/jlib/ordhttp.jar` JDK 6 or later, on Windows: *<ORACLE_HOME>*`\ord\jlib\ordhttp.jar`
Name: `ordjsptag.jar` Description: Oracle Multimedia JSP Tag Library (Optional)	JavaServer Pages (JSP) applications	JDK 6 or later, on Linux and UNIX: *<ORACLE_HOME>*`/ord/jlib/ordjsptag.jar` JDK 6 or later, on Windows: *<ORACLE_HOME>*`\ord\jlib\ordjsptag.jar`
Name: `orai18n.jar` Description: NLS Character Set Conversion library (Optional)	NLS character set conversion required[1]	JDK 6 or later, on Linux and UNIX: *<ORACLE_HOME>*`/jlib/orai18n.jar` JDK 6 or later, on Windows: *<ORACLE_HOME>*`\jlib\orai18n.jar`

[1] 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 attributes of Oracle Multimedia object types 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, store the JDBC OCI shared library 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;
```

Based on the type of media to be handled in the Java application, you might also have to add one or more of following import statements:

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

2.4.2 Media Retrieval in Java

Oracle Multimedia objects can be retrieved into Java applications as Java proxy objects to the Oracle Multimedia database objects with the same names: OrdAudio, OrdDoc, OrdImage, and OrdVideo. After the JDBC connection is established, follow these steps to retrieve Oracle Multimedia Java objects:

1. Create the JDBC statement to select Oracle Multimedia objects from the database:

```
String query = "select product_photo, product_audio,"+
  " product_video, product_testimonials from" +
  " pm.online_media where product_id=3117";
PreparedStatement pstmt = conn.prepareStatement(query);
```

2. Execute the query and obtain the result set:

```
OracleResultSet rset = (OracleResultSet)pstmt.executeQuery();
```

3. Retrieve the Oracle Multimedia Java object from the result set:

```
if ( rset.next() )
{

  OrdImage imgProxy = (OrdImage)rset.getORAData(
          "product_photo", OrdImage.getORADataFactory());
  OrdAudio audProxy = (OrdAudio)rset.getORAData(
          "product_audio", OrdAudio.getORADataFactory());
  OrdVideo vidProxy = (OrdVideo)rset.getORAData(
          "product_video", OrdVideo.getORADataFactory());
  OrdDoc docProxy = (OrdDoc)rset.getORAData(
          "product_testimonials",
          OrdDoc.getORADataFactory());
}
```

> **Note:** In your Java program environment, be sure to use the same version for both the Oracle Multimedia Java Client library (`ordim.jar`) and the Oracle JDBC library.

4. Retrieve the media attributes. Media attributes can be retrieved directly from Oracle Multimedia Java objects. For example:

```
int height = imgProxy.getHeight();
int width = imgProxy.getWidth();
String audFormat = audProxy.getFormat();
String vidMimetype = vidProxy.getMimeType();
```

2.4.3 Media Upload in Java

Follow these steps to upload media data into Oracle Multimedia database objects in a Java application:

1. Enter this statement to enable the JDBC connection object to set the autocommit flag to `false`:

```
conn.setAutoCommit(false);
```

2. Retrieve Oracle Multimedia Java objects from the database for updating. You can load media data into existing Oracle Multimedia objects in a table or into nonexisting Oracle Multimedia objects by creating a new row in a table.

   The following example includes a query you can use to load media data into existing Oracle Multimedia objects in a table.

```
//"for update" is required in the query string
//since we will update the row later.
String query1 = "select product_photo," +
" product_audio, product_video," +
" product_testimonials from" +
" pm.online_media where product_id=3106" +
" for update";

PreparedStatement pstmt = conn.prepareStatement(query1);

OracleResultSet rset = (OracleResultSet)pstmt.executeQuery();

if ( rset.next() )
{

  OrdImage imgProxy = (OrdImage)rset.getORAData(
          "product_photo", OrdImage.getORADataFactory());
  OrdAudio audProxy = (OrdAudio)rset.getORAData(
          "product_audio", OrdAudio.getORADataFactory());
  OrdVideo vidProxy = (OrdVideo)rset.getORAData(
          "product_video", OrdVideo.getORADataFactory());
  OrdDoc docProxy = (OrdDoc)rset.getORAData(
          "product_testimonials",
          OrdDoc.getORADataFactory());
}

rset.close();
pstmt.close();
```

   The following example includes a query you can use to load media data into nonexisting Oracle Multimedia objects by creating a new row.

> **Note:** This code segment assumes that there is no row with `product_id=3106` in the `pm.online_media` table.

```
String query2 =
  "begin insert into pm.online_media " +
  " (product_id, product_photo, product_audio," +
  " product_video, product_testimonials) values" +
  " (3106, ordimage.init()," +
  " ordaudio.init(), ordvideo.init()," +
  " orddoc.init()) returning product_photo," +
  " product_audio, product_video," +
```

```
  " product_testimonials into ?, ?, ?, ?;end;";

OracleCallableStatement cstmt =
 (OracleCallableStatement) conn.prepareCall(query2);
cstmt.registerOutParameter(1, OrdImage._SQL_TYPECODE,
                               OrdImage._SQL_NAME);
cstmt.registerOutParameter(2, OrdAudio._SQL_TYPECODE,
                               OrdAudio._SQL_NAME);
cstmt.registerOutParameter(3, OrdVideo._SQL_TYPECODE,
                               OrdVideo._SQL_NAME);
cstmt.registerOutParameter(4, OrdDoc._SQL_TYPECODE,
                               OrdDoc._SQL_NAME);

cstmt.execute();

OrdImage imgProxy = (OrdImage)cstmt.getORAData(1,
                     OrdImage.getORADataFactory());
OrdAudio audProxy = (OrdAudio)cstmt.getORAData(2,
                     OrdAudio.getORADataFactory());
OrdVideo vidProxy = (OrdVideo)cstmt.getORAData(3,
                     OrdVideo.getORADataFactory());
OrdDoc docProxy = (OrdDoc)cstmt.getORAData(4,
                     OrdDoc.getORADataFactory());

cstmt.close();
```

3. Load the media data from a file to the Oracle Multimedia Java objects by calling the loadDataFromFile method:

```
String imageFileName = "laptop.jpg";
String audioFileName = "laptop.mpa";
String videoFileName = "laptop.rm";
String docFileName = "laptop.jpg";
imgProxy.loadDataFromFile(imageFileName);
audProxy.loadDataFromFile(audioFileName);
vidProxy.loadDataFromFile(videoFileName);
docProxy.loadDataFromFile(docFileName);
```

4. Set the properties of the Oracle Multimedia objects by populating the Java object fields with media attributes (optional):

```
imgProxy.setProperties();
audProxy.setProperties(new byte[1][64]);
vidProxy.setProperties(new byte[1][64]);
docProxy.setProperties(new byte[1][64], true);
```

> **Note:** The setProperties method tries to recognize the format of the media and populate the objects field with media information such as image height, image width, format, MIME type, and so on. If the media format is not recognized, the java.sql.SQLException error is thrown.

5. Update the database table with Oracle Multimedia Java objects that have data already loaded:

```
String query3 = "update pm.online_media set" +
 " product_photo=?, product_audio=?," +
 " product_video=?, product_testimonials=?" +
 " where product_id=3106";
```

```
   OraclePreparedStatement pstmt =
(OraclePreparedStatement)conn.prepareStatement(query3);
   pstmt.setORAData(1, imgProxy);
   pstmt.setORAData(2, audProxy);
   pstmt.setORAData(3, vidProxy);
   pstmt.setORAData(4, docProxy);

   pstmt.execute();
   pstmt.close();
```

6. Commit the transaction:

```
conn.commit();
```

2.4.4 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. These examples are extracted from the Java sample applications that are described in Chapter 3 and Chapter 5.

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. These examples are included in the Oracle Multimedia Java API sample application, the Oracle Multimedia Java Servlet Photo Album application, and the Oracle Multimedia JavaServer Pages Photo Album application.

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

- Handling the Setting of Properties for Unknown Image Formats in Java
- Handling Image Processing for Unknown Image Formats in Java

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

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

The `IMUtil` class of the Oracle Multimedia Java API sample application contains utility methods for common image functions. One of these methods is the setProperties( ) method. The static method takes an OrdImage object as an input parameter and calls the setProperties( ) method on the object.

```
static boolean setProperties(OrdImage img)
  {
    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. See Chapter 5 for a full description of the Oracle Multimedia Java API sample application, and for more information about using the setProperties( ) method in a Java application.

2.4.4.2 Handling Image Processing for Unknown Image Formats in Java

In the insertNewPhoto( ) method in both the `PhotoAlbumServlet` class of the Oracle Multimedia Java Servlet Photo Album application and in the `PhotoAlbumBean` class of the Oracle Multimedia JavaServer Pages Photo Album application, a new photograph is inserted into the photo album, creating a thumbnail image at the same time. If the 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` block and `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.

2.5 Developing Java-Based Web Applications

On the Java platform, a Web application is a dynamic extension of a Web server. A Java-based Web application is composed of Java servlets, JSP pages, or both. Java servlets are Java classes that dynamically process HTTP requests and construct HTTP responses. JSP pages are text-based documents that execute as servlets, but enable a more natural approach to creating static content.

Oracle Multimedia Servlets and JSP Java API is based on Oracle Multimedia Java API. The classes in Oracle Multimedia Servlets and JSP Java API facilitate the retrieval and uploading of media data from and to Oracle Database in a Java-based Web application.

The Java classes in Oracle Multimedia Servlets and JSP Java API are included in the `oracle.ord.im.*` package. The classes are as follows:

- OrdHttpResponseHandler
- OrdHttpJspResponseHandler
- OrdHttpUploadFormData
- OrdHttpUploadFile
- OrdMultipartFilter
- OrdMultipartWrapper

The OrdHttpResponseHandler class facilitates the retrieval of the media data from Oracle Database and its delivery to an HTTP client from a Java servlet. The OrdHttpJspResponseHandler class provides the same features for JSP pages. The OrdHttpUploadFormData, OrdHttpUploadFile, OrdMultipartFilter, and OrdMultipartWrapper classes facilitate the uploading of media data from a Web client to Oracle Database.

Before you can begin using Oracle Multimedia Servlets and JSP Java API, you must set up your environment with the appropriate Java libraries, as described in Step 1, Section 2.4.1.

The following subsections describe how to use various components of the Java development environment for Web applications:

- Media Retrieval in Java-Based Web Applications
- Media Upload in Java-Based Web Applications

See Also:

Oracle Multimedia Servlets and JSP Java API Reference for details about the available classes and methods in this Java API

2.5.1 Media Retrieval in Java-Based Web Applications

In general, displaying a Web page that contains images in a Web browser requires two HTTP round trips.

In the first trip, the Web browser makes an HTTP request to the URL of the Web page that contains the images. The Web server responds with the Web page text content and the URLs for the media content. The URL is the `src` attribute of the `<img>` tag in the Web page.

In the second trip, the Web browser makes another HTTP request to the URL in the `<img>` tag to get the image binary data, and then displays the image in the browser.

In a Java-based Web application, sending media data from the database to an HTTP client (Web browser) requires the proper media URL (generated in the first HTTP response); and the proper media delivery component (a servlet or JSP for the second HTTP response).

The following subsections provide additional details and examples of this process:

- Media URL
- Media Delivery Component

2.5.1.1 Media URL

When media data is stored as static files on the Web server, the media URL is the relative or absolute path to the media files on the file system. When media data is stored in a database, the media URL is generally composed of a media delivery component (a servlet or JSP) and the parameters for the media delivery component. The media delivery component is the target for the second HTTP request to retrieve the media data. The parameters for the media delivery component are used by the media delivery component to query and locate the media data in the database. For example:

```
<img src="OrdGetMedia.jsp?id=1"/>
```

where `OrdGetMedia.jsp` in the media URL `"OrdGetMedia.jsp?id=1"` is the media delivery component, and `id=1` is the parameter to the media delivery component.

2.5.1.2 Media Delivery Component

Because media data is stored in the database as Oracle Multimedia objects, the media delivery component must dynamically retrieve the media data as Java objects (see Section 2.4.2), based on certain query conditions. Then, you can use either the OrdHttpResponseHandler or the OrdHttpJspResponsehandler class in Oracle Multimedia Servlets and JSP Java API to deliver the data to the HTTP client (Web browser).

The following example demonstrates the use of a Java servlet as the media delivery component, and highlights in bold the SQL statements and significant areas in the code where this operation takes place.

```
import oracle.ord.im.OrdHttpResponseHandler;

protected void doGet(HttpServletRequest request,
 HttpServletResponse response)
  throws ServletException, java.io.IOException
{
// obtain oracle.ord.im.OrdImage object
// imgProxy follows the Section "Media Retrieval in Java"
 . . .

// deliver the image data to the browser
OrdHttpResponseHandler handler =
new OrdHttpResponseHandler( request, response);
handler.sendImage(imgProxy);

 . . .
 }
```

The following example demonstrates the use of a JSP page as the media delivery component, and highlights in bold the SQL statements and significant areas in the code where this operation takes place.

```
<%@ page
import="oracle.ord.im.OrdHttpJspResponseHandler"
%>

<jsp:useBean id = "handler" scope="page"
     class = "oracle.ord.im.OrdHttpJspResponseHandler"
/>

<%
// obtain oracle.ord.im.OrdImage object
// imgProxy follows the Section "Media Retrieval in Java"
. . .

// deliver the image data to the browser
   handler.setPageContext( pageContext );
   handler.sendImage(imgProxy);
   return;
%>
```

2.5.2 Media Upload in Java-Based Web Applications

The HTML form enables you to input and upload data from a Web browser to a Web server for processing. The following HTML code segment is an example of the HTML form that uploads a file. This code example highlights in bold the SQL statements and areas in the code where this operation takes place.

```
<form action="uploadAction.jsp" method="post"
enctype="multipart/form-data">
id: <input type="text" name="id"/>
description: <input type="text" name="description"/>
Photo: <input type="file" name="photo"/>
</form>
```

Referring to the preceding code example, setting the value of the `enctype` attribute in the `<form>` tag to "`multipart/form-data`" specifies multipart/form-data format encoding of the uploaded data. The value of the `action` attribute in the `<form>` tag represents the name of the JSP that handles the uploaded data.

To handle the uploaded data in a JSP or servlet, follow these steps:

1. Decode the uploaded file. Because this file is encoded in multipart/form-data format, the data must be decoded before further processing can proceed. You can use the OrdHttpUploadFormData class to decode the encoded HTTP request data and obtain the uploaded file as an instance of the OrdHttpUploadFile object. You can use this class explicitly or implicitly to get the decoded uploaded file.

   The following example demonstrates how to use the OrdHttpUploadFormData class *explicitly* to get the uploaded file, and highlights in bold the SQL statements and significant areas in the code where this operation takes place. Use this method within the servlet or JSP that handles the upload HTTP request.

   ```
   //
   // Import OrdHttpUploadFormData and OrdHttpUploadFile class:
   // In a servlet:
   // import oracle.ord.im.OrdHttpUploadFormData;
   // import oracle.ord.im.OrdHttpUploadFile;
   // In a JSP:
   // <%@ page import="oracle.ord.im.OrdHttpUploadFormData" %>
   // <%@ page import="oracle.ord.im.OrdHttpUploadFile" %>
   //
   ```

```
//
// Following code snippets should be within <% %> if in a JSP.
//

// Create an OrdHttpUploadFormData object and use it to parse
// the multipart/form-data message.
//
OrdHttpUploadFormData formData = new OrdHttpUploadFormData(
 request );
formData.parseFormData();

//
// Get the description, location, and photo.
//
String id = formData.getParameter( "id" );
String description = formData.getParameter( "description" );
OrdHttpUploadFile photo = formData.getFileParameter( "photo" );

//
// Process the uploaded file.
//
 ...

//
// Release the resources.
//
formData.release();
```

To avoid instantiating and releasing the OrdHttpUploadFormData class explicitly in each JSP or servlet that handles the uploaded data, you can use the OrdHttpUploadFormData class implicitly by configuring the Web application with the OrdMultipartFilter class. Using the OrdMultipartFilter class ensures that any HTTP request that is encoded in multipart/form-data format is decoded and passed along to the JSP or servlet that further processes the request.

The following substeps and accompanying examples describe how to use the OrdHttpUploadFormData class *implicitly* to get the uploaded file. These code examples highlight in bold the SQL statements and significant areas in the code where this operation takes place.

a. Configure the filter by adding this code to the `web.xml` file in your Web application:

```
<filter>
    <filter-name>OrdMultipartFilter</filter-name>
    <filter-class>
oracle.ord.im.OrdMultipartFilter
    </filter-class>
</filter>
<filter-mapping>
    <filter-name>OrdMultipartFilter</filter-name>
    <servlet-name>*.jsp</servlet-name>
</filter-mapping>
```

b. Obtain the form data and the uploaded file in the JSP or servlet after the filter is configured:

```
//
// Get the id, description, and photo.
//
String id = request.getParameter( "id" );
```

```
String description = request.getParameter( "description" );
 oracle.ord.im.OrdHttpUploadFile photoFile =
  request.getFileParameter("photo");
```

where `request` is the HttpServletRequest object passed to the JSP or servlet.

2. Save the uploaded file to the database. After the OrdHttpUploadFile object is obtained by explicitly or implicitly using the OrdHttpUploadFormData class, the uploaded file is ready to be loaded into an Oracle Multimedia object in the database, using this statement:

   ```
   photoFile.loadImage(imgProxy);
   ```

   where `photoFile` is the OrdHttpUploadFile object and `imgProxy` is an OrdImage object obtained in Step 1 in Section 2.4.3.

   The loadImage method implicitly calls the setProperties method to populate the object fields.

   After the data is loaded into the Oracle Multimedia Java object, you can update the corresponding Oracle Multimedia object in the database table by following Steps 4 and 5 in Section 2.4.3.

3

Oracle Multimedia Photo Album Sample Applications

This chapter describes media upload and retrieval Web applications using Oracle Multimedia object types, using these distinct Oracle Multimedia Photo Album sample Web applications:

- Oracle Multimedia PL/SQL Photo Album Sample Application uses the PL/SQL Gateway and PL/SQL Web Toolkit for Oracle Fusion Middleware and Oracle Database (see Section 3.1 on page 3-2)
- Oracle Multimedia Java Servlet Photo Album Sample Application uses the Oracle Multimedia Servlets and JSP Java API (see Section 3.2 on page 3-23)
- Oracle Multimedia JSP Photo Album Sample Application uses the Oracle Multimedia Servlets and JSP Java API (see Section 3.3 on page 3-31)

This chapter assumes the following:

- You are familiar with:
  - Developing PL/SQL applications using the PL/SQL Gateway and PL/SQL Web Toolkit
  - Developing Java-based Web applications using JDBC, creating Java source code, compiling it into byte code (`.class`) files, and deploying class files into respective servlet containers required by Oracle HTTP Server for Oracle Fusion Middleware and Oracle Database
- You have installed and configured these sample applications:
  - Oracle Multimedia PL/SQL Web Toolkit Photo Album application
  - Oracle Multimedia Java Servlet Photo Album application
  - Oracle Multimedia JSP Photo Album application

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

More Sample Applications

See these chapters for more sample applications:

Chapter 4 describes the Oracle Multimedia Code Wizard sample application, a media upload and retrieval Web application for the PL/SQL Gateway.

Chapter 5 describes the Oracle Multimedia Java API sample application. This sample application lets you retrieve, save, play, and delete multimedia data from the Oracle

Database sample schemas using Oracle Multimedia Java classes and Oracle Multimedia object types.

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.

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:

- Running the PL/SQL Photo Album Application
- Description of 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 the tasks shown in Table 3–1. The tasks and the Web pages are introduced in this section and described in further detail in the following sections.

Table 3–1 PL/SQL Photo Album Sample Application Overview

User Task	Web Page	PL/SQL Procedures

Browsing the photo album
Section 3.1.2.1
	View album
	Figure 3–1
		`view_album`
		Example 3–1
		
		`print_album`
		Example 3–2
		
		`print_image_link`
		Example 3–3
		
		`deliver_media`
		Example 3–4

Adding images to the photo album
Section 3.1.2.2
	Upload photo
	Figure 3–2
		`view_upload_form`
		
		`print_upload_form`
		Example 3–5
		
		`insert_new_photo`
		Example 3–6

Searching for images by keyword or phrase
Section 3.1.2.3
	Search album
	Figure 3–3
		`view_album`
		Example 3–1
		
		`print_album`
		Example 3–2

Viewing full-size images
Section 3.1.2.4
	View entry
	Figure 3–4
		`view_entry`
		Example 3–7
		
		`print_image_link`
		Example 3–3
		
		`deliver_media`
		Example 3–4

Table 3–1 (Cont.) PL/SQL Photo Album Sample Application Overview

User Task	Web Page	PL/SQL Procedures

Examining image metadata
Section 3.1.2.5
	View metadata
	Figure 3–5
		`view_metadata`
		Example 3–8
		
		`print_metadata`
		Example 3–9

Writing new XMP metadata to images Section 3.1.2.6	**Write XMP metadata** Figure 3–6	`write_metadata` Example 3–10
Searching for images that contain specific metadata attributes Section 3.1.2.7	**Search metadata** Figure 3–7	`search_metadata` Example 3–11

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

- Browsing the Photo Album

  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

  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

  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

  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

  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

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

  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 Section 3.1.2.3.

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 Section 3.1.2.7 and Section 3.1.2.2, respectively.

Figure 3–1 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. (Section 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 contains some relevant lines of code in the view_album 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;
```

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 contains some relevant lines of code in the print_album procedure.

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>');
```

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 contains some relevant lines of code in the `print_image_link` procedure.

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 );
```

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 contains some relevant lines of code in the `deliver_media` procedure.

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;
```

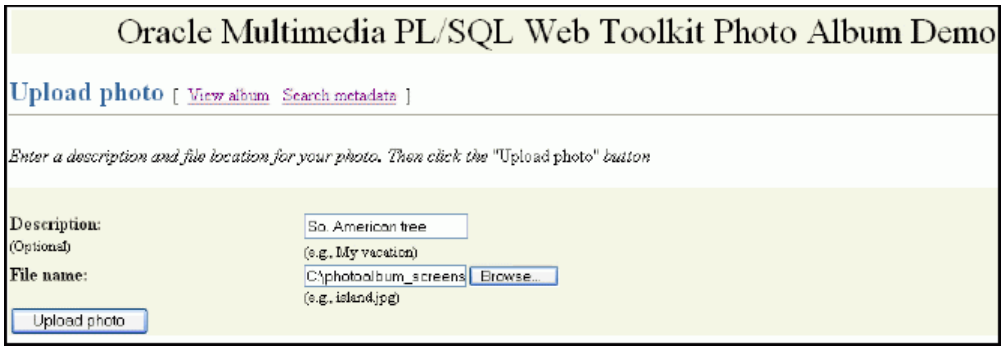
3.1.2.2 Adding Images to the Photo Album

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 Section 3.1.2.1.

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 Section 3.1.2.1 and Section 3.1.2.7, respectively.

Figure 3–2 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. The target of the form is PHOTO_ALBUM.INSERT_NEW_PHOTO.

Example 3–5 contains some relevant lines of code in the `print_upload_form` procedure.

Example 3–5 Procedure print_upload_form

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

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 contains some relevant lines of code in the `insert_new_photo` procedure.

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 Section 3.1.2.1, Section 3.1.2.7, and Section 3.1.2.2, respectively.

Figure 3–3 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 Section 3.1.2.1 for a discussion of this procedure.

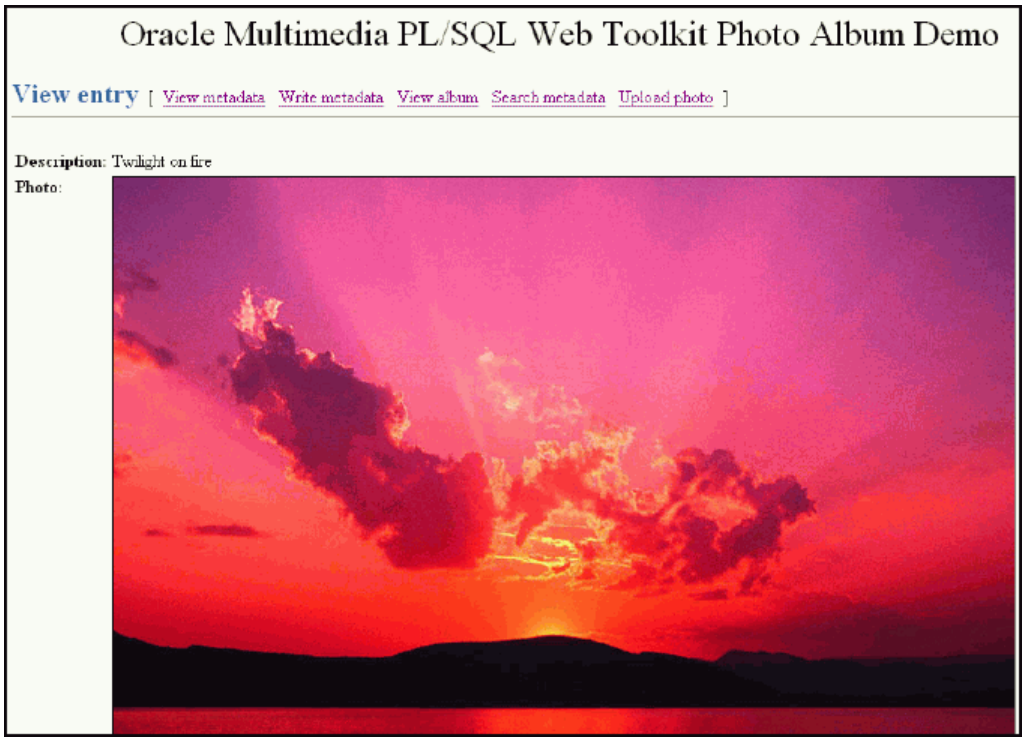
3.1.2.4 Viewing Full-Size Images

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 Section 3.1.2.1, Section 3.1.2.5, Section 3.1.2.6, Section 3.1.2.7, and Section 3.1.2.2, respectively.

Figure 3–4 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 Section 3.1.2.1 for more information about the `print_image_link` and `deliver_media` procedures.

Example 3–7 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 Section 3.1.2.1, Section 3.1.2.4, Section 3.1.2.6, Section 3.1.2.7, and Section 3.1.2.2, respectively.

Figure 3–5 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 contains some relevant lines of code in the `view_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;
```

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 contains some relevant lines of code in the `print_metadata` procedure.

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.

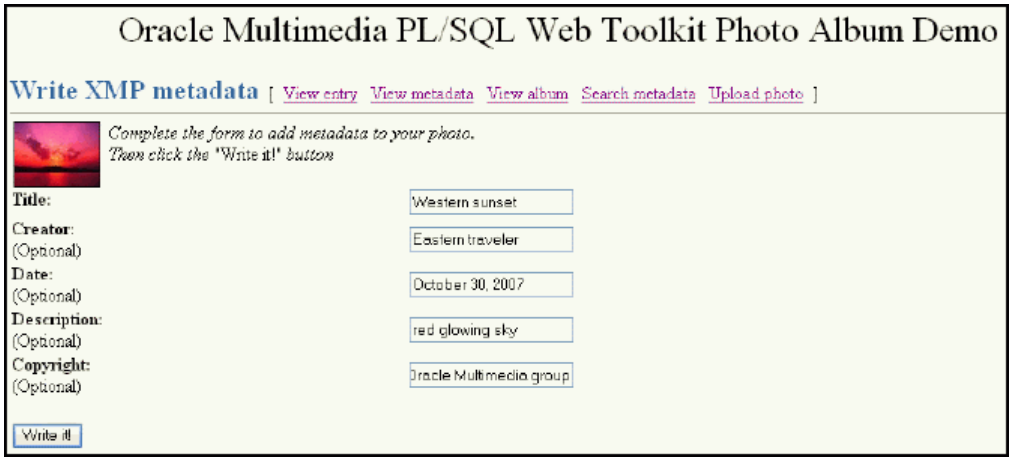
Click **Write it!** to send the form to the application and embed the metadata in XMP format in the image.

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 Section 3.1.2.1,

Section 3.1.2.4, Section 3.1.2.5, Section 3.1.2.7, and Section 3.1.2.2, respectively.

Figure 3–6 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 contains some relevant lines of code in the `write_metadata` procedure.

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;
```

The input data shown in Example 3–10 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>
```

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.

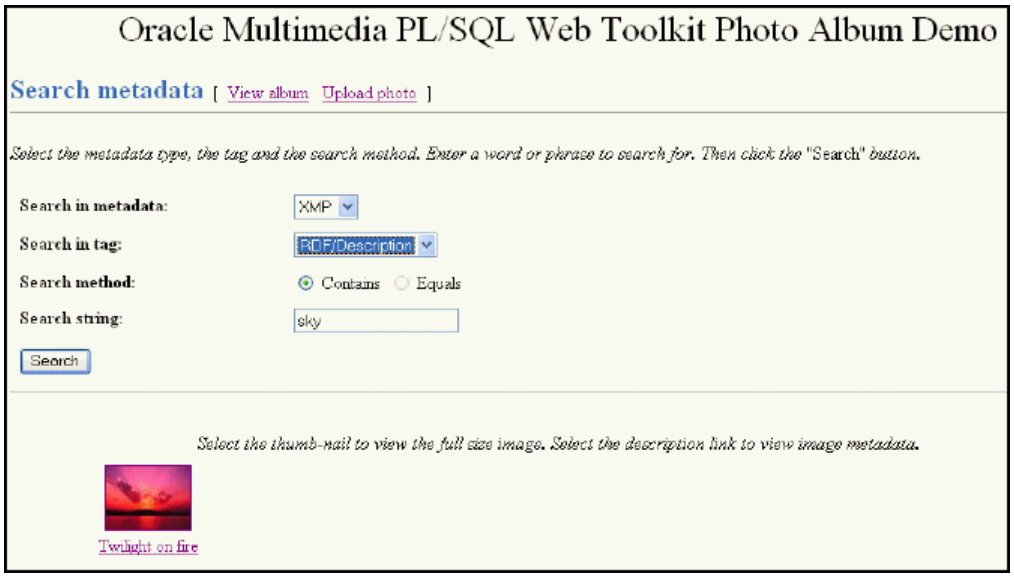
In the **Search method:** field, select **Contains** to specify a search where an element contains the search string. Select **Equals** to specify a search where element values are matched exactly to the search string. For searches in XMP metadata, only the **Contains** search method is available.

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 Section 3.1.2.1 and Section 3.1.2.2, respectively.

Figure 3–7 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 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.' );
```

3.2 Oracle Multimedia Java Servlet Photo Album Sample Application

The Oracle Multimedia Java Servlet Photo Album sample application demonstrates the use of the Oracle Multimedia Servlets and JSP Java API to upload and retrieve multimedia data to and from the database. Users access this photo album application to view the contents of the photo album, including thumbnail versions of each photograph, to view the full-size version of any photograph, and to upload new photographs into the album.

This photo album application demonstrates the use of the Oracle Multimedia image object type to upload and retrieve media data stored in Oracle Database.

When installed, this photo album application creates a table named `photos` and a sequence named `photos_sequence`.

The `photos` table is described by the following CREATE TABLE statement:

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

The data type for the `image` and `thumb` columns are defined as Oracle Multimedia image object types to store the full-size images and the generated thumbnail images.

The photos_sequence sequence is defined by the following CREATE SEQUENCE statement:

```
CREATE SEQUENCE photos_sequence;
```

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

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

<ORACLE_HOME>\ord\http\demo\servlet (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 Java Servlet Photo Album application:

- Running the Java Servlet Photo Album Application
- Description of the Java Servlet Photo Album Application

3.2.1 Running the Java Servlet Photo Album Application

After you have completed the setup tasks and have built the Java Servlet Photo Album application, you are ready to run it.

In the address field of your Web browser, enter the URL for the default installation of Oracle Fusion Middleware, as follows:

<protocol><hostname:port-number>/servlet/PhotoAlbumServlet

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 new photo**. Enter a description of the photograph, the location where the photograph was taken, 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.

3.2.2 Description of the Java Servlet Photo Album Application

The Java Servlet Photo Album application combines both business logic and the presentation into a single servlet, which when compiled, creates two class files, PhotoAlbumServlet.class and PhotoAlbumRequest.class.

To follow along with the description of tasks, refer to a copy of the PhotoAlbumServlet.java file, which is available in:

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

<ORACLE_HOME>\ord\http\demo\servlet (on Windows)

PhotoAlbumServlet Class

The `PhotoAlbumServlet` class performs these tasks:

- Extends the HttpServlet and contains the user-entered connection information.

```
public class PhotoAlbumServlet extends HttpServlet
```

- Instantiates a Java stack used to implement a simple connection-pooling mechanism.

```
private static Stack connStack = new Stack();
```

- Defines a flag to indicate whether the JDBC Thin driver has been loaded.

```
private static boolean driverLoaded = false;
```

- Defines a servlet initialization method.

```
public void init( ServletConfig config ) throws ServletException
{
    super.init(config);
}
```

- Defines a doGet( ) method to process an HTTP GET request containing an HttpServletRequest object and HttpServletResponse object, and instantiates a PhotoAlbumRequest object to process the request to deliver either a full-size or thumbnail image to the browser, or to display an upload form or the contents of the photo album as thumbnail images.

```
public void doGet( HttpServletRequest request,
                   HttpServletResponse response )
    throws ServletException, IOException
{
    Connection conn = null;

    //
    // Use a try-block to ensure that JDBC connections are always returned
    // to the pool.
    //
    try
    {
        //
        // Get a JDBC connection from the pool.
        //
        conn = getConnection();

        //
        // Instantiate a PhotoAlbumRequest object to process the request.
        //
        PhotoAlbumRequest albumRequest =
            new PhotoAlbumRequest( conn, request, response );

        //
        // Figure out what to do based on query string parameters.
        //
        String view_media = request.getParameter( "view_media" );
        if ( view_media != null )
        {
            //
            // Deliver a full-size or thumbnail image to the browser.
            //
            albumRequest.viewMedia( view_media );
```

```
            return;
        }
        else if ( request.getParameter( "view_form" ) != null )
        {
            //
            // Display the HTML upload form.
            //
            albumRequest.viewUploadForm();
        }
        else if ( request.getParameter( "view_entry" ) != null )
        {
            //
            // Display full-size photo image.
            //
            albumRequest.viewPhoto();
        }
        else
        {
            //
            // Display album contents with thumbnail images by default.
            //
            albumRequest.viewAlbum();
        }
    }
    catch ( SQLException e )
    {
        //
        // Log what went wrong.
        //
        e.printStackTrace( System.out );

        //
        // Turn SQL exceptions into ServletExceptions.
        //
        throw new ServletException( e.toString() );
    }
    finally
    {
        //
        // If we have a JDBC connection, then return it to the pool.
        //
        freeConnection( conn );
    }
}
```

- Defines a doPost( ) method to process an HTTP POST request used to upload a new photograph into the album by instantiating a PhotoAlbumRequest object to process the request and then calling the insertNewPhoto( ) method.

```
public void doPost( HttpServletRequest request,
                    HttpServletResponse response )
    throws ServletException, IOException
{
    Connection conn = null;

    //
    // Use a try-block to ensure that JDBC connections are always returned
    // to the pool.
    //
    try
```

```
        {
            //
            // Get a JDBC connection from the pool.
            //
            conn = getConnection();

            //
            // Instantiate a PhotoAlbumRequest object to process the request.
            //
            PhotoAlbumRequest albumRequest =
                new PhotoAlbumRequest( conn, request, response );

            //
            // Insert the photo into the album.
            //
            albumRequest.insertNewPhoto();
        }
        catch ( SQLException e )
        {
            //
            // Log what went wrong.
            //
            e.printStackTrace( System.out );

            //
            // Turn SQL exceptions into ServletExceptions.
            //
            throw new ServletException( e.toString() );
        }
        finally
        {
            //
            // If we have a JDBC connection, then return it to the pool.
            //
            freeConnection( conn );
        }
    }
```

In summary, the `PhotoAlbumServlet` class responds to the HTTP GET and POST requests by allocating a JDBC connection from a connection pool. Each HTTP GET or POST request is assigned its own JDBC connection from the pool to ensure that multiple requests can be serviced concurrently. An HTTP GET request is used to retrieve image data from the photo album, and an HTTP POST request is used to upload image data into the photo album. Then, an instance of the `PhotoAlbumRequest` class is created to execute the request, it executes the request, then it releases the JDBC connection back to the pool after completing the request.

See Also:

Oracle Database JDBC Developer's Guide for detailed information about using JDBC connections

PhotoAlbumRequest Class

The `PhotoAlbumRequest` class does the actual processing of an HTTP GET or POST request, and defines the getPreferredFormat( ) function and these methods:

viewAlbum( )
viewPhoto( )
viewMedia( )

viewUploadForm( )
insertNewPhoto( )
printPageHeader( )
printPageTrailer( )
printMessage( )
printHeading( )
printLink( )

In the viewMedia( ) and insertNewPhoto( ) methods, three objects, OrdHttpResponseHandler, OrdHttpUploadFormData, and OrdHttpUploadFile, are instantiated. These objects are used to call the methods of the respective `OrdHttpResponseHandler`, `OrdHttpUploadFormData`, `OrdHttpUploadFile` classes of Oracle Multimedia Servlets and JSP Java API. For example, in the viewMedia( ) method, the OrdHttpResponseHandler object is instantiated and used to call the sendImage( ) method, as shown in the following code:

```
OrdHttpResponseHandler handler =
    new OrdHttpResponseHandler( request, response );
handler.sendImage( img );
```

The viewAlbum( ), viewPhoto( ), viewMedia( ), and insertNewPhoto( ) methods use the getORAData( ) and getORADataFactory( ) methods supplied by Oracle to get the image or thumbnail OrdImage object from the result set to obtain height and width information, to retrieve an image from an OrdImage Java object and deliver it to the browser, and to upload an image in an OrdImage Java object and to also update it in the `photos` table. For example, the following code segment is from the viewAlbum( ) method:

```
OrdImage img =
    (OrdImage)rset.getORAData( 4, OrdImage.getORADataFactory() );
.
.
.
out.print( "<td headers=\"image\"><a href=\"" + servletUri +
           "?view_entry=yes&id=" + id + "\">" );
if ( img.getContentLength() > 0 )
{
    if (img.getMimeType().startsWith("image/"))
    {
     out.print( "<img src=\"" + servletUri +
                            "?view_media=thumb&id=" + id + "\"" +
                            " height=" + img.getHeight() +
                            " width=" + img.getWidth() +
                            " alt=\"" + description + "\"" +
         " border=1>" );
    }
}
else
{
    out.print( "[view image]" );
}
out.println( "</a></td>" );
out.println( "</tr>" );
```

What follows is a more detailed description of each method and what it does:

- The viewAlbum( ) method does the following:
  - Initializes the row count to zero.

  - Writes a common page header on the HTML page using the function printPageHeader( ).
  - Executes a SELECT statement to fetch all the thumbnail images in the photo album, order them by description, and display the description and location information for each along with the thumbnail image if it exists, and returns the results in a result set.
  - Displays the thumbnail images in an HTML table with column headers labeled `Description`, `Location`, and `Image`.
  - Within a `while` block, reads the contents of the result set by reading the first row's contents beginning with the `id` value, displays the description and location values, then gets the thumbnail OrdImage object and builds the height and width attributes for each thumbnail image.
  - Displays the thumbnail image using an HTML anchor tag that can be used to display the full-size image. When a user clicks the thumbnail image or **view image**, the full-size image is displayed.
  - Displays the contents of the photo album within an HTML anchor tag using the tag `<IMG SRC="<servlet-path>?view_media=thumb&id=...">` to display the thumbnail images, where `<servlet-path>` is the value of `servletUri`. If the thumbnail image was not created because the image format was not supported by Oracle Multimedia, the text **view image** is displayed instead.
  - Increments the row count to see if the photo album is empty; if so, it displays the message "The photo album is empty".
  - Displays an HTML anchor tag near the bottom of the HTML page using the printLink( ) function with the text **Upload new photo**.
  - Writes a common trailer at the bottom of the HTML page by calling the printPageHeader( ) function, however, in this case, sets the Boolean argument to false to not display the common page trailer.
  - Closes the result set and the statement.

- The viewPhoto( ) method displays the full-size version of a photograph and does the following:
  - Writes a common page header on the HTML page using the function printPageHeader( ).
  - Gets the value of the `id` column for the entry being viewed.
  - Executes a SQL SELECT statement to fetch the entry's description, location, and full-size image where the value of `id` in the `where` clause is a parameter marker and returns the results in a result set.
  - Gets the image OrdImage object from the result set so it can later build the image height and width attributes within the `<IMG SRC=...>` image tag.
  - Displays the full-size image in an HTML table beginning with the column names `Description` and `Location`, and displays the entry's values for these two columns.
  - Builds the URL to fetch a full-size image for this entry by using an image tag `<IMG SRC="<servlet-path>?view_media=image&id=...">` to display an image in the column labeled `Photo`, where `<servlet-path>` is the value of `servletUri`.
  - Displays the full-size images height and width by calling the getHeight( ) and getWidth( ) Oracle Multimedia object methods. If the image format is not

recognized by Oracle Multimedia, height and width values are zero and are not displayed.

  - Writes a common page trailer at the bottom of the HTML page by calling the printPageHeader( ) function and setting its Boolean argument to true to display the common page trailer.
  - Closes the result set and the statement.

- The viewMedia( ) method is invoked by both thumbnail and full-size image URLs to retrieve a thumbnail or full-size image from the `photos` table and deliver it to the browser using the `OrdHttpResponseHandler` class. This method does the following:
  - Executes a SQL SELECT statement to fetch either the thumbnail or full-size image where the value of `id` in the `where` clause is a parameter marker and returns the results in a result set. The SQL SELECT statement is built dynamically with the string `media` equating to either the thumbnail image column or the full-size image column.
  - Fetches a row from the result set.
  - Gets the OrdImage object from the result set.
  - Uses the `OrdHttpResponseHandler` class to create an OrdHttpResponseHandler object to retrieve the image from the OrdImage object and deliver it to the browser using the sendImage( ) method. The sendImage( ) method supports browser content caching by supporting the If-Modified-Since and Last-Modified headers.
  - Closes the result set and the statement.
- The viewUploadForm( ) method displays an HTML form that enables users to upload new photographs and does the following:
  - Calls the printPageHeader( ) function to produce the common page header.
  - Defines the form action as a multipart/form-data POST request.
  - Calls the `upload_form_fields` static string containing the contents of the upload form. The upload form is defined as a table with rows labeled `Description` and `Location`, with an input type of text and named description and location respectively, followed by a row labeled `File name:`, with an input type of `file` and named `photo`, and finally a row with no label, an input type of `submit`, and a value of `Upload photo`.
  - Calls the printPageTrailer( ) function to produce the common page trailer.
- The insertNewPhoto( ) method does the following:
  - Uses the `OrdHttpUploadFormData` class to parse a multipart/form-data POST request containing an uploaded photograph.
  - Uses the `OrdHttpUploadFile` class to upload the new photograph into the database.
  - Executes a SQL SELECT photos_sequence.nextval statement to get the next value of the `id` column for the new row to be inserted into the `photos` table.
  - Executes a SQL INSERT statement to insert a new row in the `photos` table.
  - Executes a SQL SELECT...FOR UPDATE statement to fetch the initialized full-size and thumbnail image objects from the `photos` table.

  - Calls the loadImage( ) method in the `OrdHttpUploadFile` class to populate an OrdImage object named `image` with the full-size image and sets the properties or attribute values of the image object based on the image contents.
  - Checks to see what the image format is and if it is an image format that cannot be displayed inline by a browser, such as a BMP image format, then calls the getPreferredFormat( ) method to convert a BMP image format and return the preferred image format.
  - Calls the ProcessCopy( ) method in the `OrdImage` class to process the full-size image, create a thumbnail image, and populate an OrdImage object named `thumb`.
  - Executes a SQL UPDATE statement to update the full-size and thumbnail images in the database.
  - Displays a photo upload success message and then directs the browser to refresh the page.

- A getPreferredFormat( ) private function, in this sample application, converts a BMP image format and returns the preferred image file format based on the number of colors in the image; returns a MONOCHROME image format if there are no colors, or a JPEG if there are more than 8 colors, or a GIF if there are greater than 0 and fewer than 8 colors.
- A printPageHeader( ) private function displays an HTML header that is common to all HTML responses.
- A printPageTrailer( ) private function displays an HTML trailer that is common to all HTML responses.
- A printMessage( ) private function prints a message on the HTML page.
- A printHeading( ) private function prints a header on the HTML page.
- A printLink( ) function produces an HTML anchor tag in a standard format.

3.3 Oracle Multimedia JSP Photo Album Sample Application

The Oracle Multimedia JSP Photo Album sample application is a JavaServer Pages (JSP) application that demonstrates the use of the Oracle Multimedia Servlets and JSP Java API to upload and retrieve multimedia data to and from a database. Users access the JSP files that constitute the application to view the contents of the photo album, including thumbnail versions of each photograph, to view the full-size version of any photograph, and to upload new photographs into the album.

This photo album application demonstrates the use of the Oracle Multimedia image object type to upload and retrieve media data stored in Oracle Database.

This photo album application, when installed, creates a table named `photos` and a sequence named `photos_sequence`.

The `photos` table is described by the following CREATE TABLE statement:

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

The data type for the `image` and `thumb` columns are defined as Oracle Multimedia image object types to store the full-size images and the generated thumbnail images.

The `photos_sequence` sequence is defined by the following CREATE SEQUENCE statement:

```
CREATE SEQUENCE photos_sequence;
```

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

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

<ORACLE_HOME>`\ord\http\demo\jsp` (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 JSP Photo Album application:

- Running the JSP Photo Album Application
- Description of the JSP Photo Album Application

3.3.1 Running the JSP Photo Album Application

After you have completed the setup tasks and have built the JSP Photo Album application, you are ready to run it.

In the address field of your Web browser, enter the URL for the default installation of Oracle Fusion Middleware, as follows:

<protocol><hostname:port-number>`/demo/PhotoAlbum.jsp`

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 new photo**. Enter a description of the photograph, the location where the photograph was taken, 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.

3.3.2 Description of the JSP Photo Album Application

The JSP Photo Album application separates the business logic from the presentation by having a JavaBean containing methods that are accessed from each of five JSP files. When compiled, the application creates the `PhotoAlbumBean.class` file, which contains the user-entered connection information and defines the functions: getId( ),

getDescription( ), getLocation( ), and getPreferredFormat( ) and the following methods:

selectTable( )
selectRowById( )
fetch( )
insertNewPhoto( )
release( )
getConnection( )
freeConnection( )
setId( )
setDescription( )
setLocation( )
getImage( )
getThumb( )

To follow along with the description of tasks, refer to a copy of each JSP file, which is available in:

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

<ORACLE_HOME>\ord\http\demo\jsp (on Windows)

In the PhotoAlbumEntryViewer, PhotoAlbumMediaViewer, PhotoAlbum, and PhotoAlbumInsertPhoto JSP files, the jsp:useBean action tag is used to establish an ID and association with the PhotoAlbumBean class and the OrdHttpJspResponseHandler and OrdHttpUploadFormData classes of Oracle Multimedia Servlets and JSP Java API. For example, the following code appears in the PhotoAlbumInsertPhoto JSP file:

```
<jsp:useBean id="album" scope="page" class="PhotoAlbumBean"/>
<jsp:useBean id="handler" scope="page"
             class="oracle.ord.im.OrdHttpJspResponseHandler"/>
<jsp:useBean id="formData" scope="page"
             class="oracle.ord.im.OrdHttpUploadFormData"/>
```

This jsp:useBean action tag is used so these objects can be referenced by their respective ID values (album, handler, and formData) to call the methods of these classes.

The OrdHttpUploadFile class of Oracle Multimedia Servlets and JSP Java API is defined as an object with the name uploadPhoto in the insertNewPhoto( ) method in the PhotoAlbumBean.java file and then used to call its loadImage( ) method to load the photograph into the photos table, as shown in the following code segments:

```
public void insertNewPhoto( OrdHttpUploadFile uploadPhoto )
        throws SQLException, ServletException, IOException
.
.
.
uploadPhoto.loadImage( image );
.
.
.
```

The insertNewPhoto( ) method defined in the PhotoAlbumBean.java file, uses the getORAData( ) and getORADataFactory( ) methods supplied by Oracle to upload an image and a thumbnail image in an OrdImage Java object. First, the method executes a SQL SELECT...FOR UPDATE statement to select the row for update, and then, executes a SQL UPDATE statement to update the image and thumb columns for that row in the photos table, as shown in the following code segments:

```
stmt = (OraclePreparedStatement)conn.prepareStatement(
            "select image,thumb from photos where id = ? for update" );
stmt.setString( 1, id );
rset = (OracleResultSet)stmt.executeQuery();
if ( !rset.next() )
{
    throw new ServletException( "new row not found in table" );
}
image = (OrdImage)rset.getORAData( 1, OrdImage.getORADataFactory());
thumb = (OrdImage)rset.getORAData( 2, OrdImage.getORADataFactory());

rset.close();
stmt.close();
.
.
.
    //
    // Prepare and execute a SQL statement to update the full-size and
    // thumbnail images in the database.
    //
    stmt = (OraclePreparedStatement)conn.prepareStatement(
                "update photos set image = ?, thumb = ? where id = ?" );
    stmt.setORAData( 1, image );
    stmt.setORAData( 2, thumb );
    stmt.setString( 3, id );
    stmt.execute();
    stmt.close();

    //
    // Commit the changes.
    //
    conn.commit();
}
```

The fetch( ) method defined in the `PhotoAlbumBean.java` file or the PhotoAlbumBean JavaBean, fetches the next row from the result set using the getORAData( ) and getORADataFactory( ) methods to retrieve the image and the thumbnail image from an OrdImage Java object, and delivers each to the browser, as shown in the following example:

```
public boolean fetch()
    throws SQLException
{
    if ( rset.next() )
    {
        id = rset.getString( 1 );
        description = rset.getString( 2 );
        location = rset.getString( 3 );
        image = (OrdImage)rset.getORAData( 4, OrdImage.getORADataFactory() );
        thumb = (OrdImage)rset.getORAData( 5, OrdImage.getORADataFactory() );
        return true;
    }
    else
    {
        rset.close();
        stmt.close();
        return false;
    }
}
```

What follows is a more detailed description of each JSP file.

PhotoAlbum.jsp

This JSP file is the entry point to the JSP Photo Album application and does the following:

- Uses the PhotoAlbumBean JavaBean to access the contents of the `photos` table.
- Uses the `OrdHttpJspResponseHandler` class to facilitate the retrieval of image data from the `photos` table and its delivery to a browser or other HTTP client from a Java servlet.
- Displays the title of the page in the HTML header and in the common page header.
- Displays the thumbnail images in a table using column headers labeled, `Description`, `Location`, and `Image`.
- Uses a `try/catch` block to ensure the JDBC connection is released.
- Calls the selectTable( ) method to select all the rows in the `photos` table.
- Initializes the row count to zero.
- Displays an entry in the photo album by calling the getDescription( ) method, then the getLocation( ) method, and then printing the values in the appropriate columns. If the location information is blank, print a space in the `Location` column.
- Displays the contents of the photo album as thumbnail images using an HTML anchor tag to call the `PhotoAlbumEntryViewer.jsp` file to get the ID value by calling the getID( ) function.
- Calls the getThumb( ) method to get the thumbnail image and calls the getContentLength( ) method to determine the image length.
- Tests to see if the value returned for the image length is greater than 0, and if so uses an image tag of the form `<IMG SRC="PhotoAlbumMediaViewer.jsp?media=thumb&...>` to display the thumbnail image; otherwise, prints the link **view image** in the column header labeled `Image`, which, when clicked, retrieves the full-size image.
- Displays a message "The photo album is empty" if the photo album is empty. If the photo album is not empty, this message is displayed "Select the thumbnail to view the full-sized image".
- Ends the `try/catch` block with a `finally` clause and releases the JDBC connection by calling the release( ) method.
- Displays a link to the upload form with the text **Upload new photo** at the bottom of the page that calls the `PhotoAlbumUploadForm.jsp` file.

PhotoAlbumEntryViewer.jsp

This JSP file is called by the `PhotoAlbum.jsp` file that displays one full-size version of a photograph in the album. This JSP file does the following:

- Uses the PhotoAlbumBean JavaBean to access the contents of the `photos` table.
- Uses the `OrdHttpJspResponseHandler` class to facilitate the retrieval of image data from the `photos` table and its delivery to a browser or other HTTP client from a Java servlet.
- Displays the title of the page in the HTML header and in the common page header.

- Defines a string named `id` that calls the getParameter( ) method to get the `id` value.
- Displays a message "Malformed URL, no id parameter" in the event the value of the `id` string is null.
- Uses a `try/catch` block to ensure the JDBC connection is released.
- Calls the selectRowById( ) method with the value of `id` to select the entry to be displayed. If the next row to be fetched for that `id` value is not found, display a message "Entry not found: <id value>".
- Displays the entry in the album by calling the getDescription( ) method and displaying its value under the header `Description`, calling the getLocation( ) method and displaying its value under the `Location` header.
- Displays one full-size version of a photograph in the album using an image tag in the form `<IMG SRC="PhotoAlbumMediaViewer.jsp?media=image&...">` under the `Photo` header.
- Displays the full-size images height and width by calling the getHeight( ) and getWidth( ) methods. If the image format is not recognized by Oracle Multimedia, height and width values are zero and are not be displayed.
- Displays a link at the bottom of the page **Return to photo album** that calls the `PhotoAlbum.jsp` file.
- Ends the `try/catch` block, and with a `finally` clause, releases the JDBC connection by calling the release( ) method.

PhotoAlbumMediaViewer.jsp

This JSP file is called by the `PhotoAlbum.jsp` and `PhotoAlbumEntryViewer.jsp` files and retrieves a single thumbnail or full-size image from the `photos` table using the PhotoAlbumBean JavaBean and delivers it to the browser using the `OrdHttpResponseHandler` class. This JSP file does the following:

- Uses the PhotoAlbumBean JavaBean to access the contents of the `photos` table.
- Uses the `OrdHttpJspResponseHandler` class to facilitate the retrieval of image data from the `photos` table and its delivery to a browser or other HTTP client from a Java servlet.
- Defines a string named `id` that calls the getParameter( ) method to get the `id` value.
- Defines a string named `media` that calls the getParameter( ) method to get the `media` value.
- Sets a condition to proceed as long as the value of the string `id` and the value of the string `media` is not null.
- Uses a `try/catch` block to ensure the JDBC connection is released.
- Calls the selectRowById( ) method to select a specific row from the `photos` table for the value of `id`.
- Delivers the full-size or thumbnail image by first calling the setPageContext( ) method of the `OrdHttpJspResponseHandler` class to specify the page context object; then, calling the getImage( ) method to return the image to the OrdImage object; then, calling the sendImage( ) method of the `OrdHttpResponseHandler` class to retrieve the image from the OrdImage object and deliver it to the browser. If the value of media is `image`, an image is delivered to the browser; if the value of media is `thumb`, a thumbnail image is delivered to the browser. The sendImage( ) method

supports browser content caching by supporting the If-Modified-Since and Last-Modified headers.

- Ends the `try/catch` block with a `finally` clause and releases the JDBC connection by calling the release( ) method.
- Displays this message in the event the request is not understood "PhotoAlbumMediaViewer.jsp - malformed URL".

PhotoAlbumUploadForm.jsp

This JSP file is called by the `PhotoAlbum.jsp` file that displays an HTML form to enable users to upload new photographs into the album. This JSP file does the following:

- Displays the title of the page in the HTML header and in its common page header.
- Displays any error message under the header "Error message" from a previous attempt to upload an image to determine whether the value of a string is not null after calling the getParameter( ) method with an argument of `error`.
- Displays a header with the text **Upload a new photo**.
- Defines the form action specifying the `PhotoAlbumInsertPhoto.jsp` file to process the upload request as a multipart/form-data POST request.
- Displays the upload form with rows labeled `Description`, `Location`, and `File name:`.
- Displays the contents of the upload form defined as a table with rows labeled `Description` and `Location`, both with an input type of `text` and named `description` and `location` respectively, followed by a row labeled `File name:` with an input type of `file` and named `photo`, and finally followed by a row with no label and an input type of `submit` and a value of `Upload photo`.
- Displays a link at the bottom of the page **Return to photo album** that calls the `PhotoAlbum.jsp` file.

PhotoAlbumInsertPhoto.jsp

This JSP file is called by the `PhotoAlbumUploadForm.jsp` file that uses the `OrdHttpUploadFormData` class to parse the POST data in a POST request containing the uploaded photograph. This JSP file does the following:

- Uses the PhotoAlbumBean JavaBean to access the contents of the `photos` table.
- Uses the `OrdHttpJspResponseHandler` class to facilitate the retrieval of image data from the `photos` table and its delivery to a browser or other HTTP client from a JSP file.
- Uses the `OrdHttpUploadFormData` class to facilitate the processing of POST requests by parsing the POST data containing the multipart/form-data encoding, and making the contents of regular form fields and uploaded files readily accessible to a JSP file.
- Sets the value of the strings `description` and `location` to `null` and the OrdHttpUploadFile object uploadPhoto to `null`.
- Uses a `try/catch` block to ensure the JDBC connection is released.
- Passes an OrdHttpUploadFile object to the `PhotoAlbumBean` class to store the photograph in the database.
- Calls the setServletRequest( ) method of the `OrdHttpUploadFormData` class to specify the ServletRequest object for the request.

- Tests to see if the request is encoded using the multipart/form-data encoding by calling the isUploadRequest( ) method of the `OrdHttpUploadFormData` class.
- Forwards the request to the `PhotoAlbumUploadForm.jsp` file if the call to the isUploadRequest( ) method returns a Boolean expression of not false.
- Parses the form data by calling the parseFormData( ) method of the `OrdHttpUploadFormData` class.
- Gets the form field values for description and location by calling the getParameter( ) method of the `OrdHttpUploadFormData` class, and also gets the name of the file to be uploaded by calling the getFileParameter( ) method of the same class.
- Tests to make sure the file name is not null from the getFileParameter( ) method call of the `OrdHttpUploadFormData` class, then calls the getOriginalFileName( ) method of the `OrdHttpUploadFile` class to ensure that the original file name as provided by the browser is not null, or that the content length of the file is empty by calling the getContentLength( ) method of the `OrdHttpUploadFile` class.
- Forwards the request to the `PhotoAlbumUploadForm.jsp` file if there is a valid image file.
- If the description is null or empty, uses the file name as the description by calling the getSimpleFileName( ) method of the `OrdHttpUploadFile` class.
- Inserts the new entry into the `photos` table by calling the setDescription( ), setLocation( ), and insertNewPhoto( ) methods in the `PhotoAlbumBean.java` JavaBean.
- Ends the `try/catch` block with a `finally` clause and releases the JDBC connection by calling the release( ) method and releases all resources held by the OrdHttpUploadFormData object by calling its release( ) method.
- Displays the updated photo album by displaying the title of the page in the HTML header and in its common page header, directing the browser to the main page by calling the `PhotoAlbum.jsp` file, then displays the header "Photo successfully uploaded into photo album" and the instruction, "Please click on link below or wait for the browser to refresh the page".
- Displays a link at the bottom of the main page **Return to photo album** that calls the `PhotoAlbum.jsp` file.

PhotoAlbumBean.java

This is a JavaBean used by the JSP files to access the database.

The first call to the JavaBean for a request causes it to allocate a JDBC connection from a connection pool. Subsequent calls by the same request reuse the same connection. After completing a request, each JSP file is responsible for calling the JavaBean to release the JDBC connection back to the pool. Each HTTP GET or POST request is assigned its own JDBC connection from the pool to ensure that multiple requests can be serviced concurrently.

These methods are defined:

- The selectTable( ) method selects all the rows in the `photos` table, orders them by location, and returns the results in a result set.
- The selectRowById( ) method selects a specific row from the `photos` table where the value of `id` in the `where` clause is a parameter marker and returns the results in a result set.

- The fetch( ) method fetches the next row from the result set.
- The insertNewPhoto( ) method does the following:
  - Uses the `OrdHttpUploadFile` class to upload the new photograph into the database.
  - Disables auto-commit by calling the setAutoCommit( ) method with an argument of false.
  - Executes a SQL SELECT photos_sequence.nextval statement to get the next value for the value of the `id` column for the new row to be inserted into the `photos` table.
  - Executes a SQL INSERT statement to insert a new row in the `photos` table.
  - Executes a SQL SELECT...FOR UPDATE statement to fetch the initialized full-size and thumbnail image objects from the `photos` table.
  - Loads the image by calling the loadImage( ) method in the `OrdHttpUploadFile` class to populate an OrdImage object named `image` with the full-size image, and sets the properties or attribute values of the image object based on the image contents.
  - Gets the image file format by calling the getContentFormat( ) method and if it is not null, and if the MIME type is BMP, then tries to process the image by calling the process( ) method and calling the getPreferredFormat( ) method to convert it to a MONOCHROME, GIF, or JPEG image format, based on the number of colors in the image.
  - Tries to copy the full-size image and process it to create the thumbnail image by calling the processCopy( ) method in the `OrdImage` class and populate the OrdImage object named `thumb`.
  - Executes a SQL UPDATE statement to update the full-size and thumbnail images in the database.
  - Commits the changes.
- A release( ) method to release the result set and statement objects, and places the JDBC connection back on the free list or stack.
- Get methods (getId( ), getDescription( ), getLocation( ), getImage( ), and getThumb( )) and the set methods (setId( ), setDescription( ), and setLocation( )) are used to get or set attributes for all attributes or columns.
- A getConnection( ) private function implements a simple JDBC connection pool.
- A freeConnection( ) private function releases the JDBC connection back to the pool after completing the request.
- A getPreferredFormat( ) private function returns the preferred image file format based on the number of bits of color in the BMP image; returns a MONOCHROME image if there are no bits of color, returns JPEG if there are more than 8 bits of color, or returns GIF if there are between 1 and 8 bits of color.

4

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

This chapter describes the Oracle Multimedia Code Wizard sample application. The Oracle Multimedia Code Wizard sample application for the PL/SQL Gateway is a media upload and retrieval Web application that uses these Oracle Multimedia image, audio, video, and heterogeneous media object types.

This chapter 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 Photo Album application. See the `README.txt` file for additional requirements and instructions on installing and configuring this sample application.

> **Note:** This discussion assumes that the Code Wizard has been installed in the ORDSYS schema.

This chapter includes these sections:

More Sample Applications

See these chapters for more sample applications:

Chapter 3 describes these Photo Album sample Web applications, which use PL/SQL scripts, Java servlet files, and JSP files to demonstrate various ways to upload and retrieve media using Oracle Multimedia object types:

- Oracle Multimedia PL/SQL Web Toolkit Photo Album application (Section 3.1)
- Oracle Multimedia Java Servlet Photo Album application (Section 3.2)
- Oracle Multimedia JSP Photo Album application (Section 3.3)

Chapter 5 describes the Oracle Multimedia Java API sample application. This sample application lets you retrieve, save, play, and delete multimedia data from the Oracle Database sample schemas using Oracle Multimedia Java classes and 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 Section 3.1).

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

- Creating a New DAD or Choosing an Existing DAD
- Authorizing a DAD
- Creating and Testing Media Upload and Retrieval Procedures
- Creating a Media Upload Procedure

- Creating a Media Retrieval Procedure
- Using the PL/SQL Gateway Document Table
- How Time Zone Information Is Used to Support Browser Caching

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 Fusion Middleware Administrator's Guide for Oracle HTTP Server in the Oracle Fusion Middleware Online Documentation Library 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

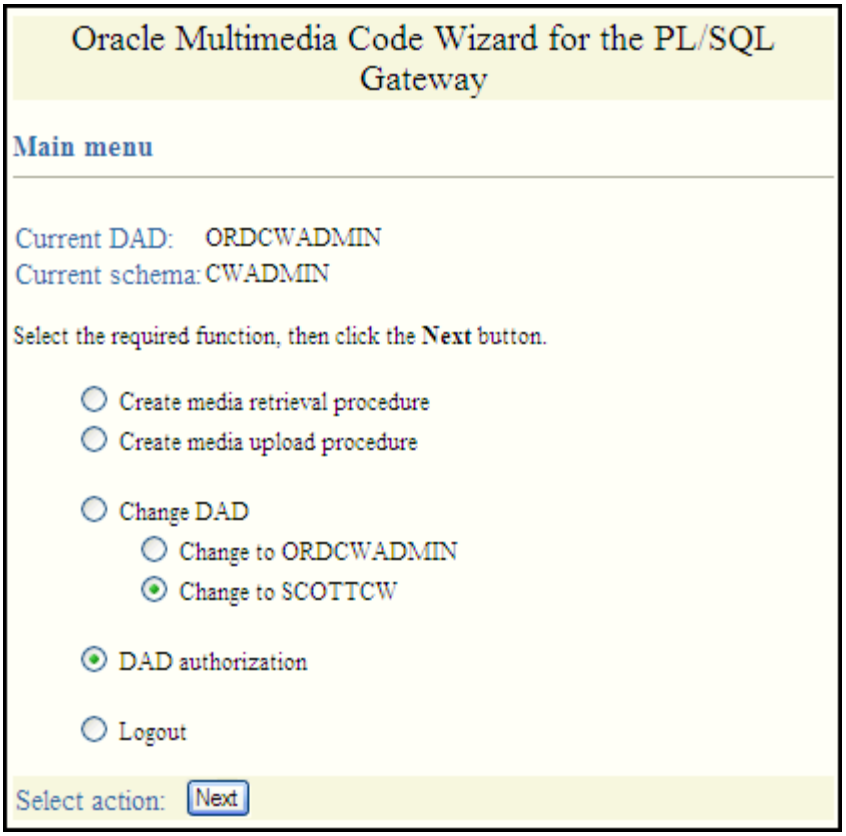
To authorize a DAD for use with the Code Wizard, perform these steps:

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

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

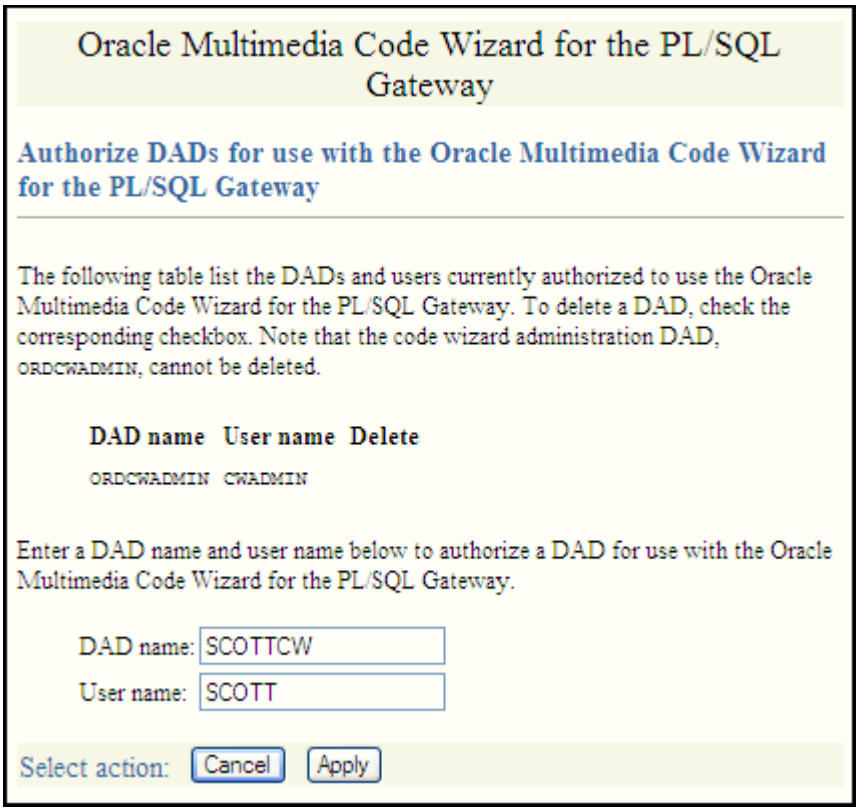
2. Enter the user name and password when prompted by the browser.
3. Select **DAD authorization** from the **Main menu**, as shown in Figure 4–1. Then, click **Next**.

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 Figure 4–2. Then, click **Apply**.

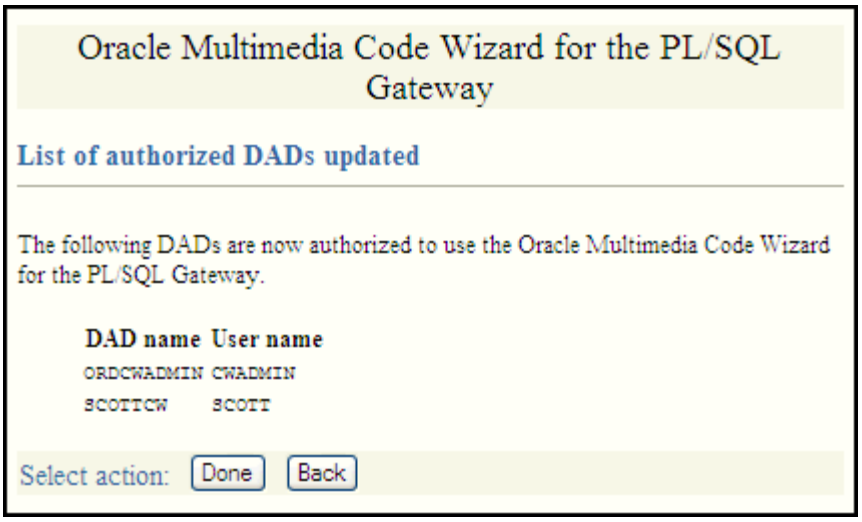
Figure 4–2 Authorize the SCOTTCW DAD



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 Figure 4–3. 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 Fusion Middleware User's Guide for mod_plsql in the Oracle Fusion Middleware Online Documentation Library

4.2.3 Creating and Testing Media Upload and Retrieval Procedures

After you have completed the setup tasks (as described in Section 4.2.1, Section 4.2.2, 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:

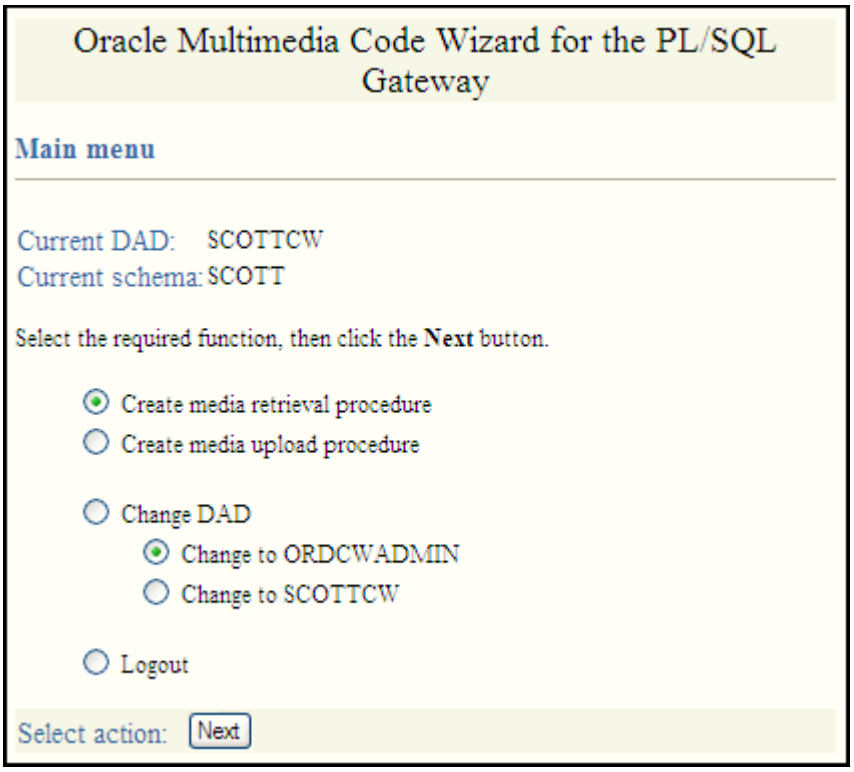
   `http://<hostname>:<port-number>/scottcw`

   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 Figure 4–4.

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's built-in `logmeoff` function.

See Also:

Oracle Fusion Middleware User's Guide for mod_plsql in the Oracle Fusion Middleware Online Documentation Library

To create a media upload procedure (see Section 4.2.4) or a media retrieval procedure (see Section 4.2.5), 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.

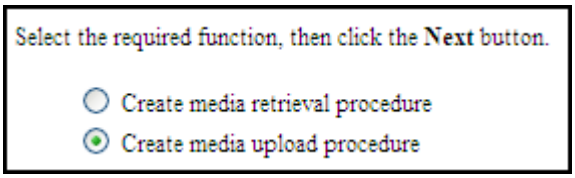
If you create a standalone media upload or retrieval procedure, you will have the opportunity to view the contents of the procedure and test it. Section 4.3 and Section 4.4, respectively, include sample sessions that demonstrate how to create and test a media upload procedure and a media retrieval procedure.

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:

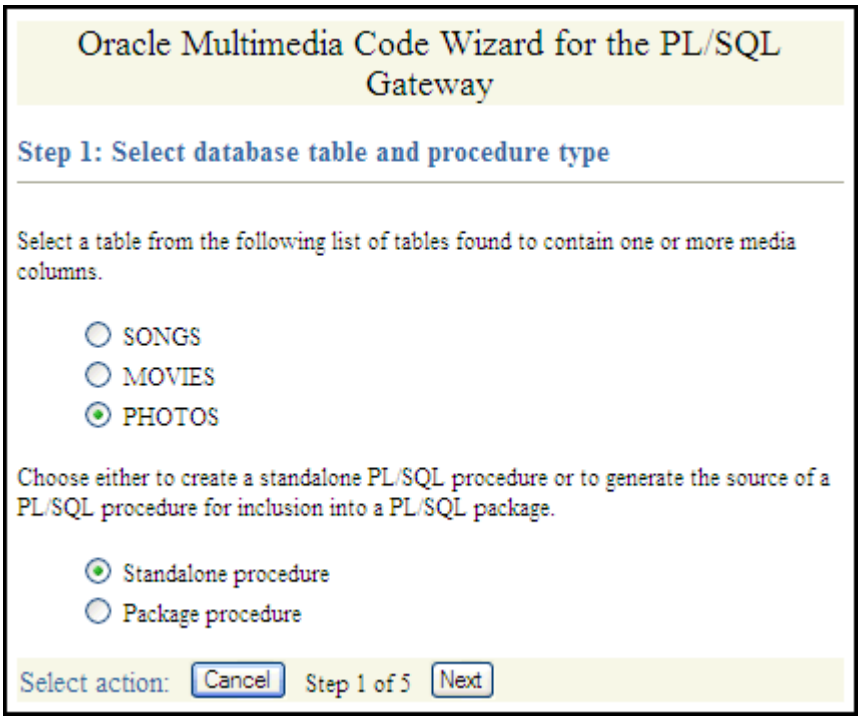
1. Select **Create media upload procedure** from the **Main menu** page, as shown in Figure 4–5. Then, click **Next**.

Figure 4–5 Create a Media Upload Procedure



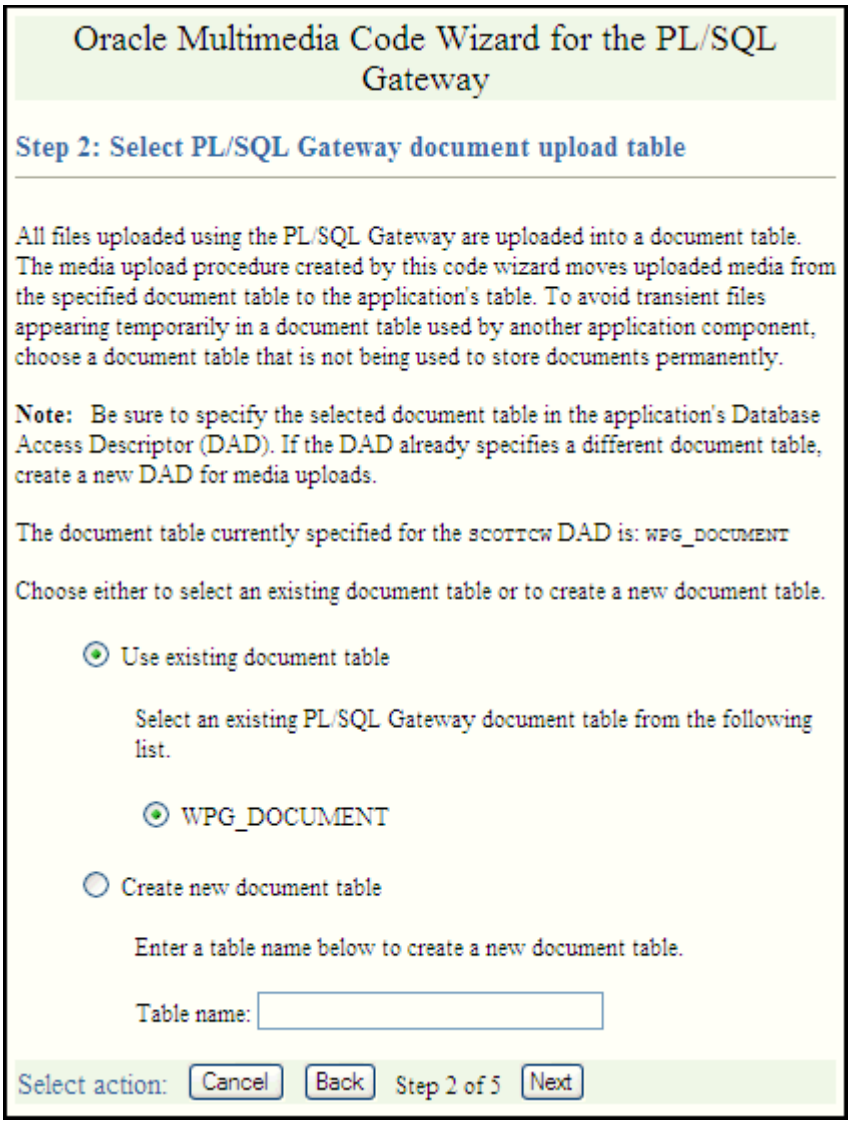
2. Select **PHOTOS** and **Standalone procedure** from **Step 1: Select database table and procedure type**, as shown in Figure 4–6. Then, click **Next**.

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



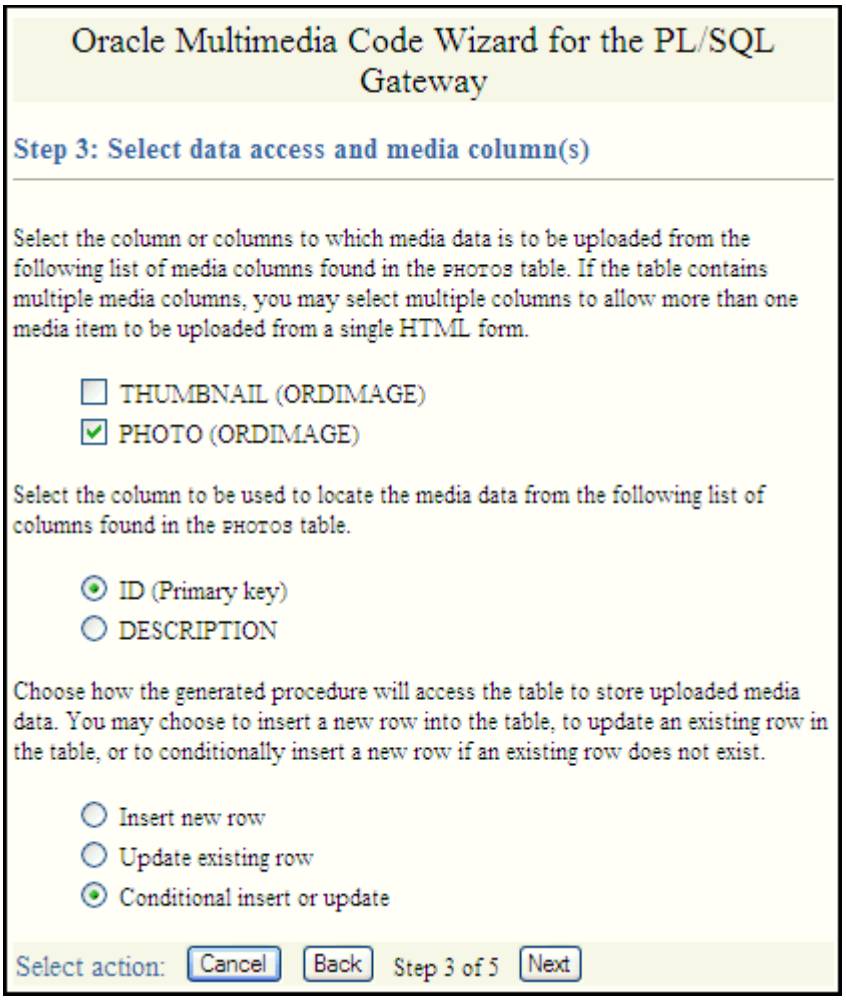
3. Select **Use existing document table** from **Step 2: Select PL/SQL Gateway document upload table**, as shown in Figure 4–7, because the `SCOTTCW` DAD is configured to use this document table. Then, click **Next**.

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



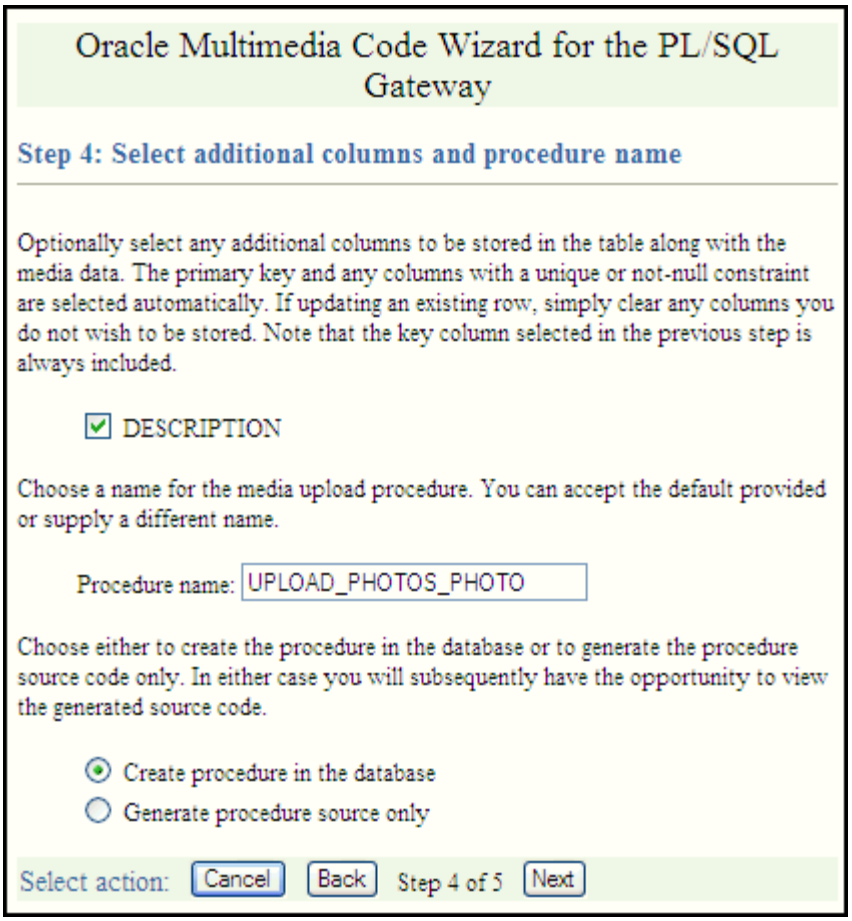
4. Check **PHOTO (ORDIMAGE),** select **ID (Primary key)**, and select **Conditional insert or update** from **Step 3: Select data access and media column(s)**, as shown in Figure 4–8. Then, click **Next**.

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



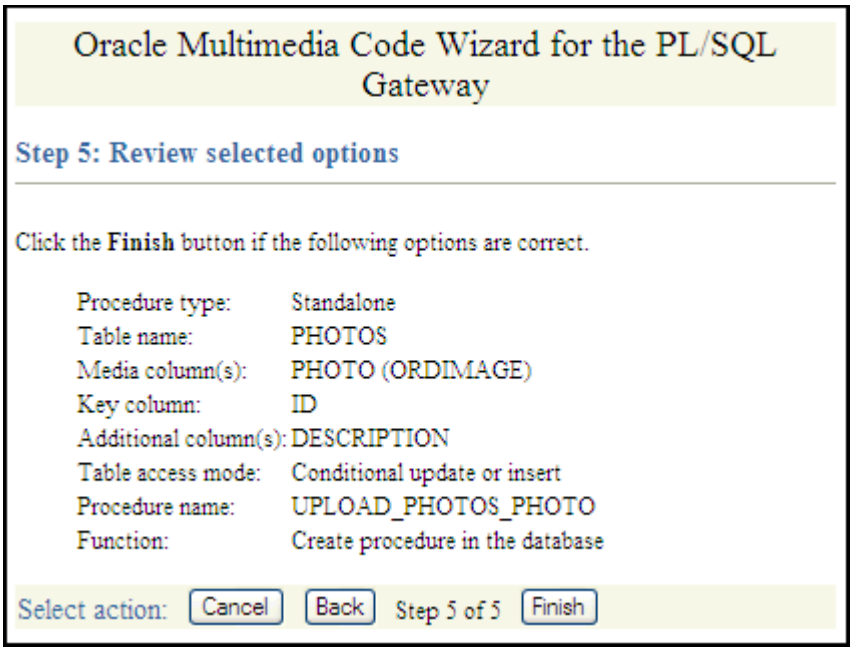
5. Check **DESCRIPTION**, accept the default procedure name, **UPLOAD_PHOTOS_PHOTO**, and select **Create procedure in the database** from **Step 4: Select additional columns and procedure name**, as shown in Figure 4–9. Then, click **Next**.

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



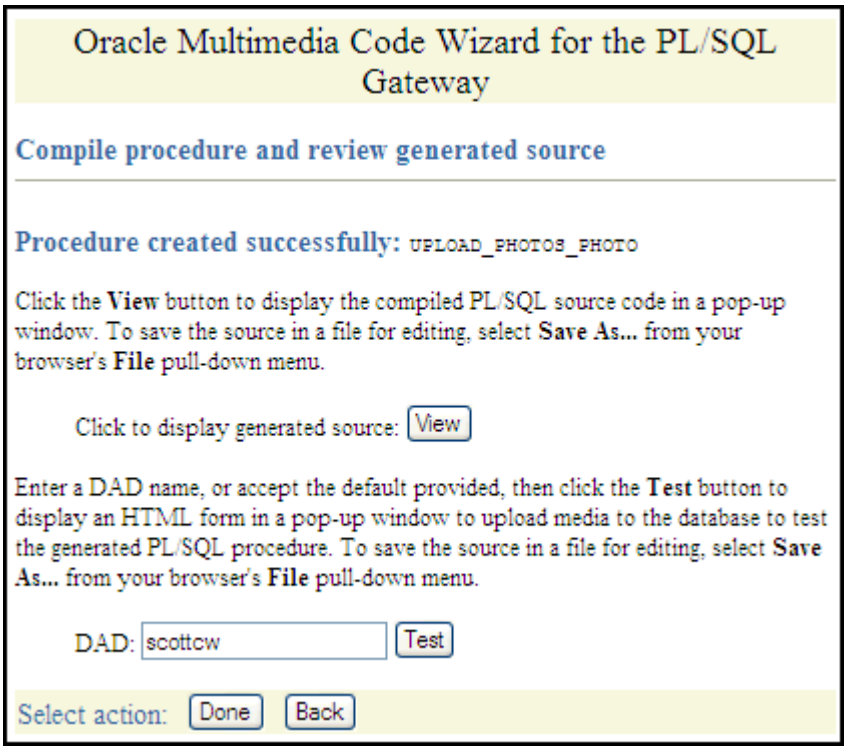
6. Review the options you selected from **Step 5: Review selected options**, as shown in Figure 4–10. If the options selected are correct, click **Finish**.

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.

Figure 4–11 Compiled Upload Procedure with Success Message



To review the compiled PL/SQL source code in another window, click **View** (see Example 4–1 for a copy of the generated upload procedure). Assuming you have

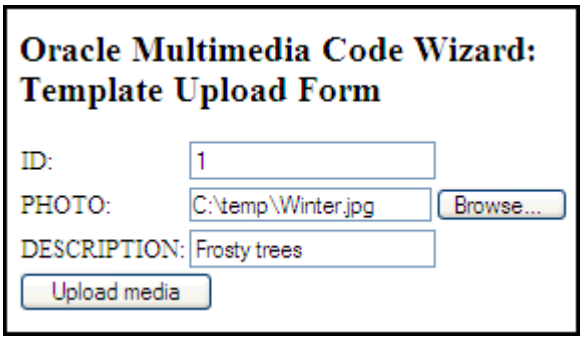
configured the SCOTTCW DAD and specified MEDIA_UPLOAD_TABLE as the document table, in the **DAD:** field, the DAD name scottcw is displayed by default.

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. 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.
```

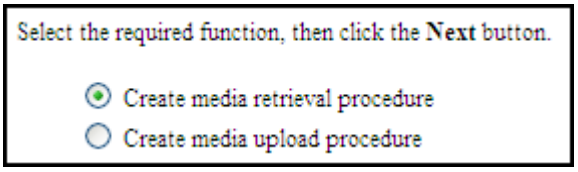
9. Return to the **Compile procedure and review generated source** page. If you are finished testing, click **Done** to return to the **Main menu** page.

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:

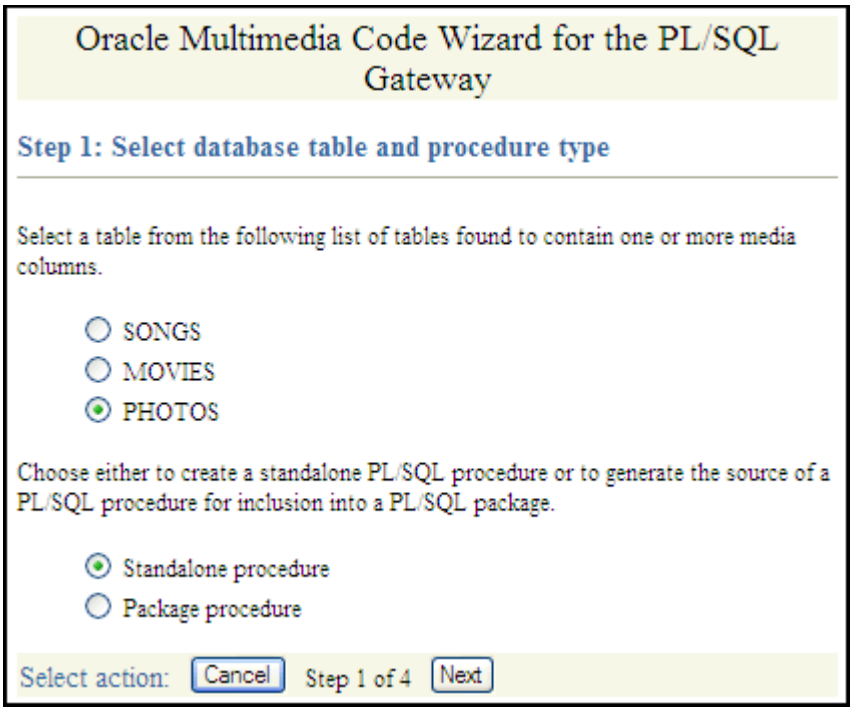
1. Select **Create media retrieval procedure** from the **Main menu** page, as shown in Figure 4–13. Then, click **Next**.

Figure 4–13 Create a Media Retrieval Procedure



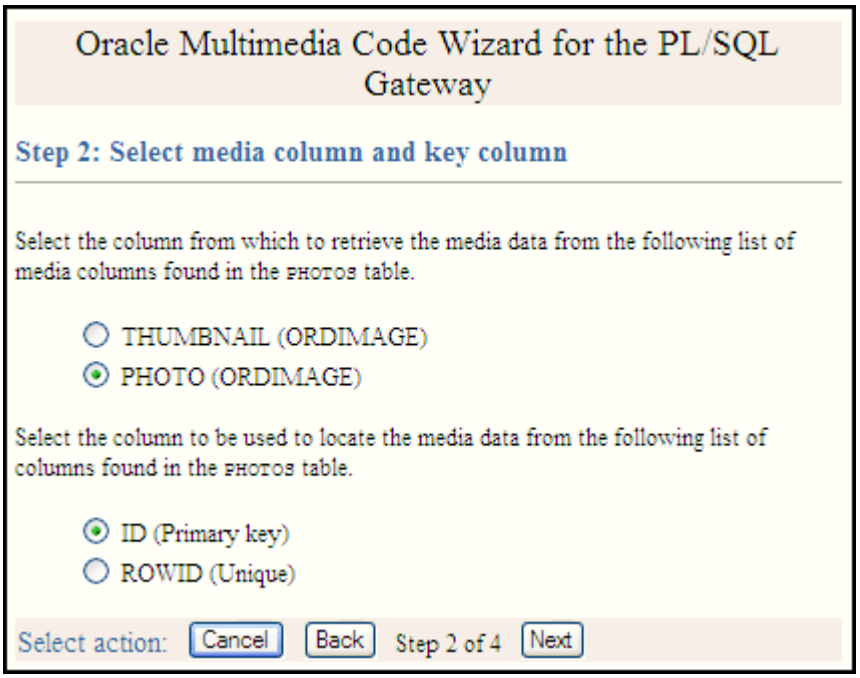
2. Select **PHOTOS** and **Standalone procedure** from **Step 1: Select database table and procedure type**, as shown in Figure 4–14. Then, click **Next**.

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



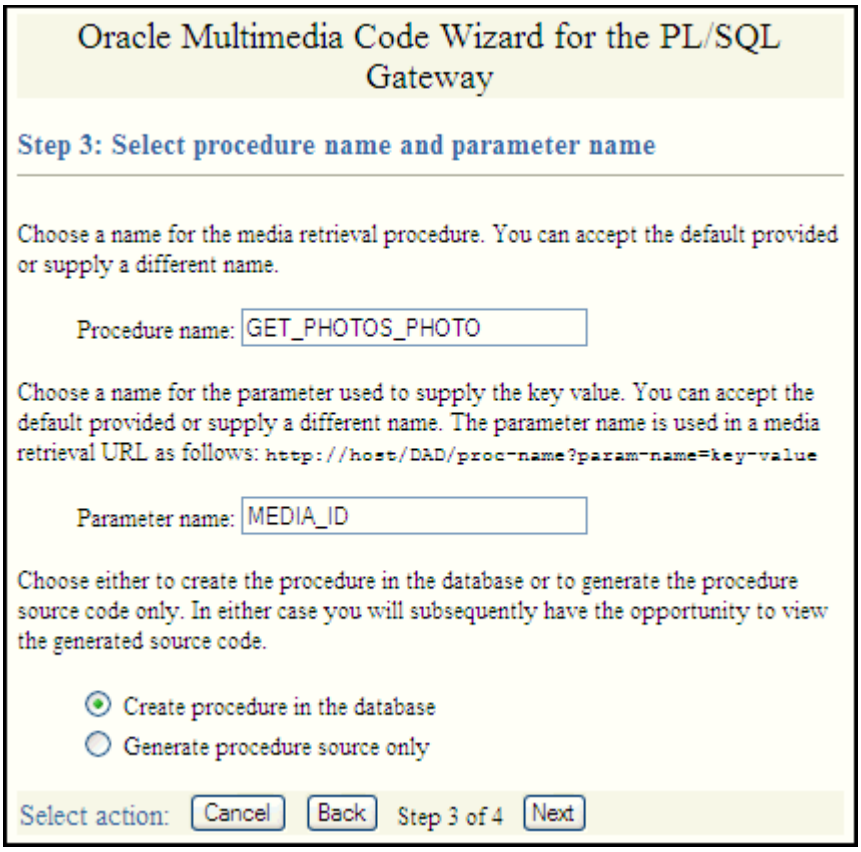
3. Select **PHOTO (ORDIMAGE)** and **ID (Primary key)** from **Step 2: Select media column and key column**, as shown in Figure 4–15. Then, click **Next**.

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



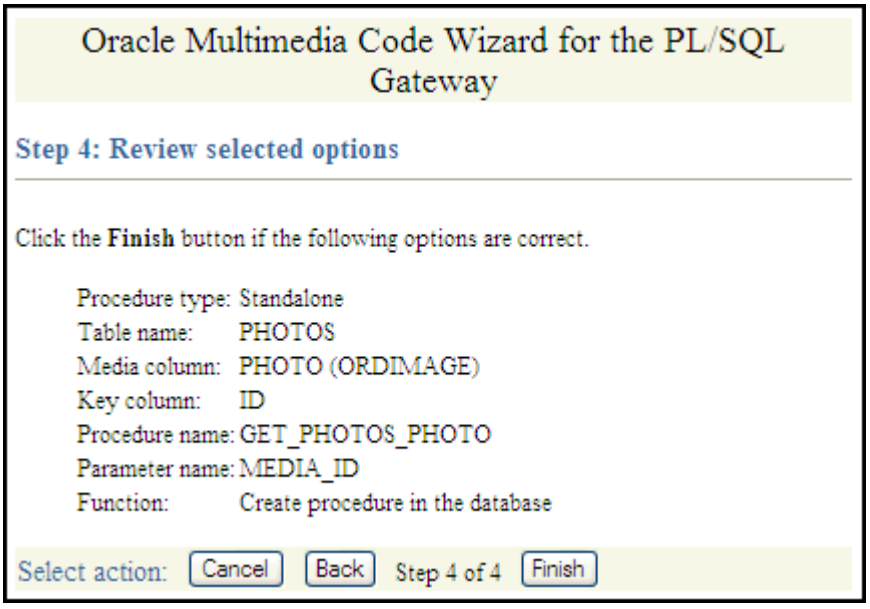
4. Accept the default procedure name, `GET_PHOTOS_PHOTO`, the default parameter name, `MEDIA_ID`, and **Create procedure in the database** from **Step 3: Select procedure name and parameter name**, as shown in Figure 4–16. Then, click **Next**.

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



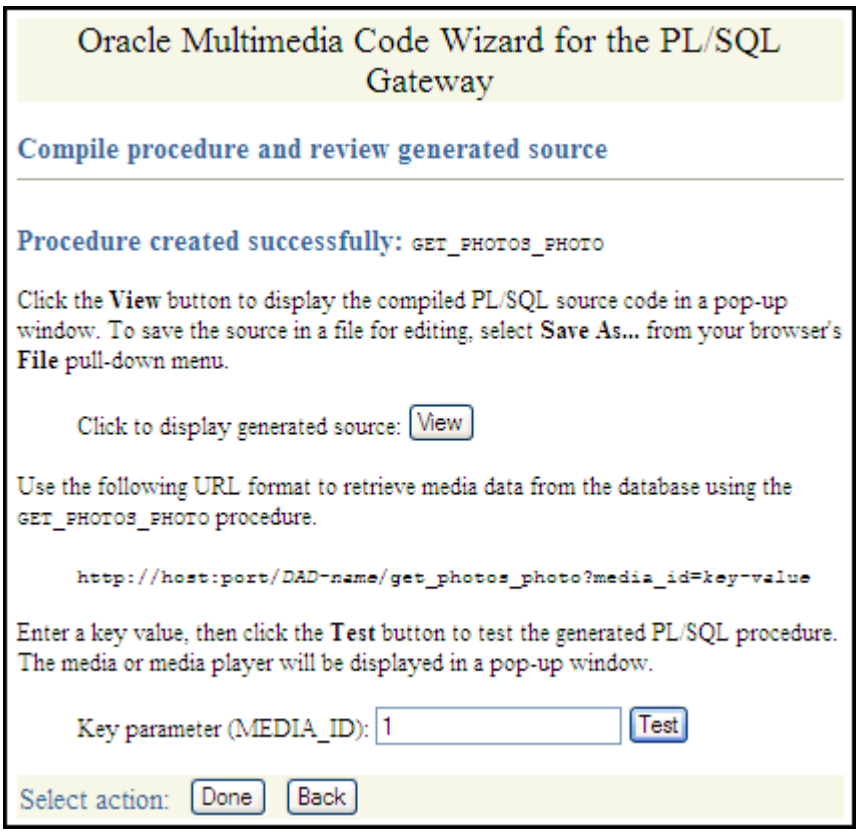
5. Review the options you selected from **Step 4: Review Selected Options**, as shown in Figure 4–17. If the options selected are correct, click **Finish**.

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.

Figure 4–18 Compiled Retrieval Procedure with Success Message



To review the compiled PL/SQL source code in another window, click **View** (see Example 4–2 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 Fusion Middleware User's Guide for mod_plsql in the Oracle Fusion Middleware Online Documentation Library 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, the Oracle9*i* and later database versions do support time zones and also provide 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 an Oracle9*i* or later 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 1: 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

This sample session assumes the Oracle Multimedia Code Wizard has been installed in the ORDSYS schema.

Perform these steps:

Step 1 Create a table to store images for the application by starting SQL*Plus and connecting to the `SCOTT` (or other) schema in the database.

For example:

```
sqlplus SCOTT [@<connect_identifer>]

Enter password: password

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.

Example 4–1 shows a copy of the generated image upload procedure:

Example 4–1 Image Upload Procedure Generated in Sample Session 1

```
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 image upload procedure shown in Example 4–1 declares these input parameters and variables:

1. In the declaration section, the procedure declares three input parameters: `in_ID`, `in_IMAGE`, and `in_DESCRIPTION`, then initializes the latter two to `NULL`.
2. 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:

1. 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.
2. 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.

3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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.
9. 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.
10. 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:

```
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**.

5. 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**.

   Example 4–2 shows a copy of the generated image retrieval procedure:

Example 4–2 Image Retrieval Procedure Generated in Sample Session 1

```
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 in Example 4–2 declares these input parameters and variables:

1. In the declaration section, the procedure declares one input parameter: `MEDIA_ID`.
2. 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:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.

7. 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.
8. 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 Sample Session 2: Using Multiple Object Columns

The following sample session uses the `SCOTT` schema to demonstrate the creation of a multiple media (multiple Oracle Multimedia object columns) upload procedure and a single media retrieval procedure. 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

This sample session assumes the Oracle Multimedia Code Wizard has been installed.

Perform these steps:

Step 1 Create a table to store audio for the application by starting SQL*Plus and connecting to the `SCOTT` (or other) schema in the database.

For example:

```
sqlplus SCOTT [@<connect_identifer>]

Enter password: password

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

Step 2 Use the `SCOTTCW` DAD you created in Step 2. Then, authorize the use of it in Step 3.

If you have not created the `SCOTTCW` DAD and authorized the use of this DAD, perform Steps 2 and 3 in this section, then continue to next step that follows in this section.

Step 3 Change DADs to the SCOTTCW DAD.

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

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

Step 4 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 **CW_MEDIA_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_MEDIA_UPLOAD_TABLE, then click **Next**.

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

   If the CW_MEDIA_UPLOAD_TABLE document table already exists, select **Use existing document table** and **CW_MEDIA_UPLOAD_TABLE**, then click **Next**.
3. Select the data access and media columns.
   a. Ensure that **IMAGE (ORDIMAGE)**, **THUMB (ORDIMAGE)**, **AUDIO (ORDAUDIO)**, **VIDEO (ORDVIDEO)**, and **MEDIA (ORDDOC)** are all checkmarked.
   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** is 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_MEDIA_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_MEDIA_TABLE
Media column(s):        IMAGE (ORDIMAGE)
                        THUMB (ORDIMAGE)
                        AUDIO (ORDAUDIO)
                        VIDEO (ORDVIDEO)
                        MEDIA (ORDDOC)
Key column:             ID
Additional column(s):   DESCRIPTION
Table access mode:      Conditional update or insert
Procedure name:         UPLOAD_CW_MEDIA_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_MEDIA_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 4, substep 6g.

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

   c. Accept the **DAD:** name provided, `SCOTTCW`, then click **Test** to display in another window 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 the following information:

      – For the **ID:** column, enter the number `1` as the row's primary key.

      – For each Oracle Multimedia object column, click **Browse...** and choose the appropriate media to upload to each column of the table. You can choose one or more or all columns to test.

      – For the **DESCRIPTION** column, enter a brief description of the media.

      – 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.

   Example 4–3 shows a copy of the generated multiple media upload procedure:

Example 4–3 Multiple Media Upload Procedure Generated in Sample Session 2

```
CREATE OR REPLACE PROCEDURE UPLOAD_CW_MEDIA_TABLE_IMAGE
  ( in_ID IN VARCHAR2,
    in_IMAGE IN VARCHAR2 DEFAULT NULL,
    in_THUMB IN VARCHAR2 DEFAULT NULL,
    in_AUDIO IN VARCHAR2 DEFAULT NULL,
    in_VIDEO IN VARCHAR2 DEFAULT NULL,
```

```
    in_MEDIA IN VARCHAR2 DEFAULT NULL,
    in_DESCRIPTION IN VARCHAR2 DEFAULT NULL )
AS
  local_IMAGE ORDSYS.ORDIMAGE := ORDSYS.ORDIMAGE.init();
  local_THUMB ORDSYS.ORDIMAGE := ORDSYS.ORDIMAGE.init();
  local_AUDIO ORDSYS.ORDAUDIO := ORDSYS.ORDAUDIO.init();
  local_AUDIO_ctx RAW( 64 );
  local_VIDEO ORDSYS.ORDVIDEO := ORDSYS.ORDVIDEO.init();
  local_VIDEO_ctx RAW( 64 );
  local_MEDIA ORDSYS.ORDDOC := ORDSYS.ORDDOC.init();
  local_MEDIA_ctx RAW( 64 );
  local_ID CW_MEDIA_TABLE.ID%TYPE := NULL;
  upload_size     INTEGER;
  upload_mimetype VARCHAR2( 128 );
  upload_blob     BLOB;
BEGIN
  --
  -- Update the existing row.
  --
  UPDATE CW_MEDIA_TABLE mtbl
    SET mtbl.IMAGE = local_IMAGE,
        mtbl.THUMB = local_THUMB,
        mtbl.AUDIO = local_AUDIO,
        mtbl.VIDEO = local_VIDEO,
        mtbl.MEDIA = local_MEDIA,
        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 a new row into the table.
    --
    INSERT INTO CW_MEDIA_TABLE ( ID, IMAGE, THUMB, AUDIO, VIDEO, MEDIA,
 DESCRIPTION )
      VALUES ( in_ID, local_IMAGE, local_THUMB, local_AUDIO,
               local_VIDEO, local_MEDIA, in_DESCRIPTION );
  END IF;
  --
  -- Select Oracle Multimedia object(s) for update.
  --
  SELECT mtbl.IMAGE, mtbl.THUMB, mtbl.AUDIO, mtbl.VIDEO, mtbl.MEDIA INTO
 local_IMAGE, local_THUMB, local_AUDIO, local_VIDEO, local_MEDIA
    FROM CW_MEDIA_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 MEDIA_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 MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_IMAGE;
END IF;
--
-- Store media data for the column in_THUMB.
--
IF in_THUMB IS NOT NULL
THEN
  SELECT dtbl.doc_size, dtbl.mime_type, dtbl.blob_content INTO
         upload_size, upload_mimetype, upload_blob
    FROM MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_THUMB;
  IF upload_size &gt; 0
  THEN
    dbms_lob.copy( local_THUMB.source.localData,
                   upload_blob,
                   upload_size );
    local_THUMB.setLocal();
    BEGIN
      local_THUMB.setProperties();
    EXCEPTION
      WHEN OTHERS THEN
        local_THUMB.contentLength := upload_size;
        local_THUMB.mimeType := upload_mimetype;
    END;
  END IF;
  DELETE FROM MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_THUMB;
END IF;
--
-- Store media data for the column in_AUDIO.
--
IF in_AUDIO IS NOT NULL
THEN
  SELECT dtbl.doc_size, dtbl.mime_type, dtbl.blob_content INTO
         upload_size, upload_mimetype, upload_blob
    FROM MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_AUDIO;
  IF upload_size &gt; 0
  THEN
    dbms_lob.copy( local_AUDIO.source.localData,
                   upload_blob,
                   upload_size );
    local_AUDIO.setLocal();
    BEGIN
      local_AUDIO.setProperties(local_AUDIO_ctx);
    EXCEPTION
      WHEN OTHERS THEN
        local_AUDIO.mimeType := upload_mimetype;
    END;
  END IF;
  DELETE FROM MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_AUDIO;
END IF;
--
-- Store media data for the column in_VIDEO.
```

```
--
IF in_VIDEO IS NOT NULL
THEN
  SELECT dtbl.doc_size, dtbl.mime_type, dtbl.blob_content INTO
         upload_size, upload_mimetype, upload_blob
    FROM MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_VIDEO;
  IF upload_size &gt; 0
  THEN
    dbms_lob.copy( local_VIDEO.source.localData,
                   upload_blob,
                   upload_size );
    local_VIDEO.setLocal();
    BEGIN
      local_VIDEO.setProperties(local_VIDEO_ctx);
    EXCEPTION
      WHEN OTHERS THEN
        local_VIDEO.mimeType := upload_mimetype;
    END;
  END IF;
  DELETE FROM MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_VIDEO;
END IF;
--
-- Store media data for the column in_MEDIA.
--
IF in_MEDIA IS NOT NULL
THEN
  SELECT dtbl.doc_size, dtbl.mime_type, dtbl.blob_content INTO
         upload_size, upload_mimetype, upload_blob
    FROM MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_MEDIA;
  IF upload_size &gt; 0
  THEN
    dbms_lob.copy( local_MEDIA.source.localData,
                   upload_blob,
                   upload_size );
    local_MEDIA.setLocal();
    BEGIN
      local_MEDIA.setProperties(local_MEDIA_ctx, FALSE);
    EXCEPTION
      WHEN OTHERS THEN
        local_MEDIA.contentLength := upload_size;
        local_MEDIA.mimeType := upload_mimetype;
    END;
  END IF;
  DELETE FROM MEDIA_UPLOAD_TABLE dtbl WHERE dtbl.name = in_MEDIA;
END IF;
--
-- Update Oracle Multimedia objects in the table.
--
UPDATE CW_MEDIA_TABLE mtbl
  SET mtbl.IMAGE = local_IMAGE,
      mtbl.THUMB = local_THUMB,
      mtbl.AUDIO = local_AUDIO,
      mtbl.VIDEO = local_VIDEO,
      mtbl.MEDIA = local_MEDIA
  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_MEDIA_TABLE_IMAGE;
```

The multiple media upload procedure shown in Example 4–3 declares these input parameters and variables:

1. In the declaration section, the procedure declares seven input parameters: `in_ID`, `in_IMAGE`, `in_THUMB`, `in_AUDIO`, `in_VIDEO`, `in_MEDIA`, and `in_DESCRIPTION`, then initializes the last six to `NULL`.
2. In the subprogram section, the following variables are declared:
   - The variables `local_IMAGE` and `local_THUMB` are assigned the data type ORDSYS.ORDIMAGE and initialized with an empty BLOB using the ORDIMAGE.init( ) method.
   - The variable `local_AUDIO` is assigned the data type ORDSYS.ORDAUDIO and initialized with an empty BLOB using the ORDAUDIO.init( ) method. Also a context variable `local_AUDIO_ctx` is assigned the data type RAW(64).
   - The variable `local_VIDEO` is assigned the data type ORDSYS.ORDVIDEO and initialized with an empty BLOB using the ORDVIDEO.init( ) method. Also, a context variable `local_VIDEO_ctx` is assigned the data type RAW(64).
   - The variable `local_MEDIA` is assigned the data type ORDSYS.ORDDOC and initialized with an empty BLOB using the ORDDOC.init( ) method. Also, a context variable `local_MEDIA_ctx` is assigned the data type RAW(64).
   - The variable `local_ID` takes the same data type as the `ID` column in the table `CW_MEDIA_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 `MEDIA_UPLOAD_TABLE` using a SELECT statement. This is all in preparation for copying the content of the image, thumb, audio, video, and media BLOB data to the respective ORDSYS.ORDIMAGE.source.localData, ORDSYS.ORDIMAGE.source.localData, ORDSYS.ORDAUDIO.source.localData, ORDSYS.ORDVIDEO.source.localData, and ORDSYS.ORDDOC.source.localData attributes.

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

1. Update the existing row in the table `CW_MEDIA_TABLE` for the `IMAGE`, `THUMB`, `AUDIO`, `VIDEO`, `MEDIA`, 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.
2. If the value returned of `local_ID` is `NULL`, conditionally insert a new row into the table `CW_MEDIA_TABLE` and initialize the instance of the ORDImage object type in the `IMAGE` column with an empty BLOB, the instance of the ORDImage

object type in the THUMB column with an empty BLOB, the instance of the ORDAudio object type in the AUDIO column with an empty BLOB, the instance of the ORDVideo object type in the VIDEO column with an empty BLOB, and the instance of the ORDDoc object type in the MEDIA column with an empty BLOB.

3. Select the ORDImage object column IMAGE, ORDImage object column THUMB, ORDAudio object column AUDIO, ORDVideo object column VIDEO, and ORDDoc object column MEDIA in the table CW_MEDIA_TABLE for update where the value of the ID column is the value of the in_ID input parameter.
4. 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 Name column is the value of one of these input parameters: in_IMAGE; in_THUMB; in_AUDIO; in_VIDEO; or in_MEDIA.
5. Perform a DBMS LOB copy of the BLOB data from the table MEDIA_UPLOAD_TABLE into the ORDSYS.ORDIMAGE.source.localData, ORDSYS.ORDIMAGE.source.localData, ORDSYS.ORDAUDIO.source.localData, ORDSYS.ORDVIDEO.source.localData, and ORDSYS.ORDDoc.source.localData attribute, then call the setLocal( ) method to indicate that the image, audio, and video data are stored locally in the BLOB, and ORDImage, ORDAudio, ORDVideo, and ORDDoc methods are to look for corresponding data in the source.localData attribute.
6. In the inner executable block, call the respective ORDImage, ORDAudio, ORDVideo, and ORDDoc setProperties( ) method to read the image, audio, and video data to get the values of the object attributes and store them in the image, audio, video, and media object attributes for the ORDImage, ORDAudio, ORDVideo, and ORDDoc objects.
7. If the setProperties( ) call fails, catch the exception and call the contentLength( ) method to get the size of the media data and call the mimeType( ) method to get the MIME type of the media data.
8. Delete the row of data from the document table MEDIA_UPLOAD_TABLE hat was copied to the row in the table CW_MEDIA_TABLE where the value of the Name column is the value of the respective in_IMAGE, in_THUMB, in_AUDIO, in_VIDEO, and in_MEDIA input parameter.
9. Update the ORDImage object IMAGE column, the ORDImage object THUMB column, the ORDAudio object AUDIO column, the ORDVideo object VIDEO column, and the ORDDoc object MEDIA column in the table CW_MEDIA_TABLE with the content of the variables local_IMAGE, local_THUMB, local_AUDIO, local_VIDEO, and local_MEDIA respectively, where the value of the ID column is the value of the in_ID input parameter.
10. 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 5 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_MEDIA_TABLE**.

b. Click **Standalone procedure**.

c. Click **Next**.

2. Select the media column and key column.

a. Ensure that one the following object columns is checkmarked. For example, if you loaded media data into the media column in Step 4, substep 6e, then select the **MEDIA (ORDDOC)** column.

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

c. Click **Next**.

3. Select the procedure name and parameter name.

a. Accept the procedure name provided, `GET_CW_MEDIA_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:

```
Procedure type:        Standalone
Table name:            CW_MEDIA_TABLE
Key column:            ID
Media column:          IMAGE (ORDDOC)
Procedure name:        GET_CW_MEDIA_TABLE_IMAGE
Parameter name:        MEDIA_ID
Function:              Create procedure in the database
```

Click **Finish**.

5. Compile the procedure and review the generated source.

The Code Wizard displays this message:

```
Procedure created successfully: GET_CW_MEDIA_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 this step.

b. Review the URL format used to retrieve images using the `GET_CW_MEDIA_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.

d. The retrieved image is displayed in another window.

e. Close the window.

f. Click **Done** to return to the **Main menu**.

Note: A generated media retrieval script, unlike the multiple media upload script shown at the end of Step 4, handles only the type of media data designed for that Oracle Multimedia object type. To retrieve media data stored in other Oracle Multimedia object types, generate a retrieval script for each desired media data type and add it to your PL/SQL package.

Example 4–4 shows a copy of the generated media retrieval procedure:

Example 4–4 Media Retrieval Procedure Generated in Sample Session 2

```
CREATE OR REPLACE PROCEDURE GET_CW_MEDIA_TABLE_MEDIA ( MEDIA_ID
 IN VARCHAR2 )
AS
  localObject ORDSYS.ORDDOC;
  localBlob  BLOB;
  localBfile BFILE;
  httpStatus NUMBER;
  lastModDate VARCHAR2(256);

BEGIN
  --
  -- Retrieve the object from the database into a local object.
  --
  BEGIN
    SELECT mtbl.MEDIA INTO localObject FROM CW_MEDIA_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_MEDIA_TABLE_MEDIA;
```

For a description of the media retrieval procedure shown in Example 4–4, see the description that follows Example 4–2 (in Section 4.3). The only difference between these two retrieval procedures is the type of object that is retrieved. Example 4–2 uses an ORDImage object type; Example 4–4 uses an ORDDoc object type.

4.5 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

Oracle Multimedia Java API Sample Application

This chapter describes the Oracle Multimedia Java API sample application. The Oracle Multimedia Java API sample application is a Java application that uses Oracle Multimedia Java classes to demonstrate how to upload, download, update, and delete Oracle Multimedia objects, including image, audio, and video. It also demonstrates how to extract attributes from media content, generate thumbnail images, and display media.

This chapter assumes the following:

- You are familiar with developing Java applications using Oracle Multimedia Java classes.
- You have installed and configured the Oracle Multimedia Java API sample application.

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

<ORACLE_HOME>`/ord/im/demo/java` (on Linux and UNIX)

<ORACLE_HOME>`\ord\im\demo\java` (on Windows)

This chapter describes how to run the Oracle Multimedia Java API sample application. See Section 2.4.1 and the `README.txt` file for additional requirements and instructions on installing, configuring, compiling, and running this sample application.

This chapter includes these sections:

More Sample Applications

See these chapters for more sample applications:

Chapter 3 describes these Photo Album sample Web applications:

- Oracle Multimedia PL/SQL Web Toolkit Photo Album application (Section 3.1)
- Oracle Multimedia Java Servlet Photo Album application (Section 3.2)
- Oracle Multimedia JSP Photo Album application (Section 3.3)

These Web applications use PL/SQL scripts, Java servlet files, and JSP files to demonstrate various ways to upload and retrieve media using Oracle Multimedia object types.

Chapter 4 describes the Oracle Multimedia Code Wizard sample application, a media upload and retrieval Web application for the PL/SQL Gateway.

5.1 Running the Oracle Multimedia Java API Sample Application

To use the Oracle Multimedia Java API sample application to retrieve, save, play, and delete multimedia data from the Oracle Database sample schemas, you must perform these steps:

1. Install Oracle Database with Oracle Multimedia.
2. Grant the appropriate permissions to the user who is connecting to the database.
3. Compile and start the sample application.
4. Log in and run the sample application.

The following section describes the Java class files, and shows code examples that demonstrate how to use Oracle Multimedia object types and methods and other Oracle objects in a Java application.

5.2 Description of the Oracle Multimedia Java API Sample Application

The Oracle Multimedia Java API sample application lets you retrieve multimedia data from the Oracle Database sample schemas, save to a file, play, and delete from the sample schema image, audio, video, and testimonial data using these Oracle Multimedia object types:

- OrdImage
- OrdAudio
- OrdVideo
- OrdDoc

This sample application uses the PRODUCT_INFORMATION table in the Order Entry (OE) sample schema, and the ONLINE_MEDIA table in the Product Media (PM) sample schema.

Note: After installing Oracle Multimedia, if the OE and PM sample schemas do not exist, you must install them manually before compiling and running the sample application.

See Also:

Oracle Database Sample Schemas for more information about the OE and PM schemas

The Oracle Multimedia Java API sample application, when compiled, creates the class files shown in Table 5–1:

Table 5–1 Java Class Files in the Compiled Sample Application

Name	Description
`IMExample`	Creates the sample application frame and maintains the only connection to the database. This class is the entry point of this sample application.

Table 5–1 (Cont.) Java Class Files in the Compiled Sample Application

Name	Description
IMExampleFrame	Extends the JFrame class and displays the main frame.
IMLoginDialog	Extends the JDialog class, displays the login dialog box, and creates the connection to the database.
IMExampleQuery	Performs the SQL SELECT statement to retrieve rows of the OE.PRODUCT_INFORMATION table and displays the content of the table by product ID.
IMProductDialog	Extends the JDialog class, shows a dialog box to display detailed information for a particular product, including the product ID, product name, and product description. The IMProductDialog class also retrieves and displays the product photo, audio, video, and testimonial data within the appropriate panel. It supports retrieving, saving, deleting, and playing the media data. And, it allows for applying changes or rolling back changes to the media objects.
IMImagePanel	Extends the IMMediaPanel class, displays the product photo and its attributes: MIME type, image height, image width, and content length, and if it applies, generates and displays the thumbnail image and displays lists for reading and writing metadata.
IMAudioPanel	Extends the IMMediaPanel class and displays the product audio and its attributes: MIME type, duration of the audio, and content length.
IMVideoPanel	Extends the IMMediaPanel class and displays the product video and its attributes: MIME type, frame height, frame width, duration of the video, and content length.
IMDocPanel	Extends the IMMediaPanel class and displays the product testimonials and its attributes: MIME type and content length.
IMLoadFile	Loads a media stream (photo, video, audio, and testimonials), from a file to the PM.ONLINE_MEDIA table in the database, and if necessary, inserts a row and initializes the media objects, then updates the media data, sets the media attributes, and generates and updates the thumbnail image if loading a photo.
IMSaveFile	Saves a media stream from the database to a target file.
IMMediaPanel	Extends the JPanel class, lays out the common components for the photo, audio, video, and doc panel with load, save, delete, and play check boxes, initializes the MIME configuration file for each operating system that lists plug-in players and media and their associated MIME types, plays the data stream associated with the MIME type of the media, and enables users to specify their own player to play the media data stream.

The major flow among these class files is: IMExample to IMExampleFrame to IMLoginDialog (login) to IMExampleFrame.showDefaultTable( ) to IMExampleQuery to IMProductDialog to one group of classes (IMImagePanel, IMAudioPanel, IMVideoPanel, IMDocPanel), and finally to the last group of classes (IMLoadFile, IMSaveFile, IMMediaPanel).

Table 5–2 lists and describes the remaining Java class files in this sample application:

Table 5–2 Additional Java Class Files in the Sample Application

Name	Description
IMUtil	Includes common utilities such as a method to generate and update thumbnail images, wrapper methods for each setProperties( ) method of each media object type to separate the exceptions caused by unrecognizable formats, and cleanup methods to close the following: resultSet, Statement, input stream and its reader, and output stream and its writer.
IMMIME	Loads and stores the mapping between plug-in players and the MIME type.
IMResultSetTableModel	Extends the AbstractTableModel class and controls the display of the OE.PRODUCT_INFORMATION table.
IMMessage	Displays various messages for the sample application and classifies the message level as error, warning, or suggestion.
IMMessageResource	Extends the java.util.ListResourceBundle class and contains the actual message text for all messages.
IMJOptionPane	Extends and puts into subclasses the JOptionPane class to add an accessible description message to the displayed dialog box.
IMGetMetadataDialog	Extends the JDialog class, and retrieves the metadata from an image into an XML document and then displays the XML document in a JTree form.
IMPutMetadataDialog	Extends the JDialog class, and constructs an XMP packet to write into an image from user inputs.
XMLTreeNode	Extends the DefaultMutableTreeNode class, and creates a tree representation of an XML node.
XMLTreeView	Extends the JPanel class, and displays an XML document as a tree.
IMFileChooser	Extends the JFileChooser class, and inherits from the JFileChooser class to add the button mnemonic and accessible description.
IMConstants	Describes the IMConstants interface, which contains all the constants for column names, media types, message types, and message dialog titles.
IMAttrTableModel	Extends and puts into subclasses the DefaultTableModel class to provide the table model for displaying media attributes, and overwrites the isCellEditable( ) method to make the cells uneditable.
FocusedJTextField	Extends and puts into subclasses the JTextField class and overwrites the isFocusTraversable( ) method to enable it to gain focus when it is set to uneditable.
FocusedJTextArea	Extends and puts into subclasses the JTextArea class and overwrites the isFocusTraversable( ) method to enable it to gain focus when it is set to uneditable; also overrides the isManagingFocus( ) method to force the JTextArea class not to handle a TAB key operation.
FocusedJPanel	Extends and puts into subclasses the JPanel class and overwrites the isFocusTraversable( ) method to enable it to gain focus.
FocusedJLabel	Extends and puts into subclasses the JLabel class, overwrites the isFocusTraversable( ) method, and adds a focus listener to enable it to gain focus.

Table 5–2 (Cont.) Additional Java Class Files in the Sample Application

Name	Description
`BooleanRenderer`	Extends the `JCheckBox` class and renders Boolean objects as JCheckBox (a check box) in a JTable (two-dimensional table format). This class also sets the AccessibleName and AccessibleDescription properties by setting the tooltip to support accessibility.
`IMStreamAbsorber`	Extends the `Thread` class and runs as a separate thread to consume an input stream. This is useful when a plug-in application is loaded and it writes something out to, for example, a standard error, without consuming the application's output, the application may be unable to continue.
`IMTable`	Extends and puts into subclasses the `JTable` class and overwrites the isManagingFocus( ) method to avoid letting the table handle a TAB key operation.
`IMTableRenderer`	Extends the `DefaultTableCellRenderer` class and renders the `PRODUCT_ID`, `PRODUCT_NAME`, and `PRODUCT_DESCRIPTION` columns to add accessibility information, and sets the customized display.
`IMUIUtil`	Includes common GUI utilities.

The following subsections describe the main operations that are performed within specific classes in the Oracle Multimedia Java API sample application:

- Operations in the IMProductDialog Class
- Operations in the IMImagePanel Class
- Operations in the IMGetMetadataDialog Class
- Operations in the IMPutMetadataDialog Class
- Operations in the IMVideoPanel Class
- Operations in the IMAudioPanel Class
- Operations in the IMDocPanel Class
- Operations in the IMLoadFile Class
- Operations in the IMUtil Class

5.2.1 Operations in the IMProductDialog Class

This class defines the following methods followed by a description of what each method does:

- The loadMedia( ) method to retrieve the media objects from the database. This method performs a SQL SELECT...FOR UPDATE statement on the `PM.ONLINE_MEDIA` table where the `PRODUCT_ID` column is a parameter marker. Then, this class uses the getORAData( ) and getORADataFactory( ) methods to get the media data objects from the result set.
- The displayMedia( ) method to display the media data, which in turn calls the corresponding media display methods displayImage( ), displayAudio( ), displayVideo( ), and displayDoc ( ).
- The displayImage( ) method calls the IMImagePanel.display( ) method to display the image data attributes, display the thumbnail image, and display the full sized image using a media player that supports this MIME type.

- The displayAudio( ) method calls the IMAudioPanel.display( ) method to display the audio data attributes and play the audio stream using a media player that supports this MIME type.
- The displayVideo( ) method calls the IMVideoPanel.display( ) method to display the video data attributes and play the video stream using a media player that supports this MIME type.
- The displayDoc( ) method calls the IMDocPanel.display( ) method to display the testimonial data attributes and play the testimonial data using a media player that supports this MIME type.

The following code example shows the loadMedia( ), displayMedia( ), displayImage( ), displayAudio( ), displayVideo( ), and displayDoc( ) methods, and highlights in bold the SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used.

```
private void loadMedia() throws SQLException, IOException
{
  String sQuery =
    "select product_photo, product_thumbnail, product_audio, product_video, " +
    "product_testimonials from pm.online_media where product_id = ? for update";

  OracleConnection conn = null;
  OracleResultSet rs = null;
  OraclePreparedStatement pstmt = null;
  boolean isInsertNeeded = false;
  byte[] ctx[] = new byte[1][64];

  try
  {
    conn = IMExample.getDBConnection();

    pstmt = (OraclePreparedStatement)conn.prepareStatement(sQuery);
    pstmt.setInt(1, m_iProdId);
    rs = (OracleResultSet)pstmt.executeQuery();
    if (rs.next() == true)
    {
      m_img = (OrdImage)rs.getORAData(1, OrdImage.getORADataFactory());
      m_imgThumb = (OrdImage)rs.getORAData(2, OrdImage.getORADataFactory());
      m_aud = (OrdAudio)rs.getORAData(3, OrdAudio.getORADataFactory());
      m_vid = (OrdVideo)rs.getORAData(4, OrdVideo.getORADataFactory());
      m_doc = (OrdDoc)rs.getORAData(5, OrdDoc.getORADataFactory());
    }

    displayMedia();

    rs.close();
    pstmt.close();
  }
  finally
  {
    IMUtil.cleanup(rs, pstmt);
  }
}

private void displayMedia() throws SQLException, IOException
{
  displayImage();
  displayAudio();
```

```
  displayVideo();
  displayDoc();
}

/**
 * Add the product photo panel.
 */
private void displayImage() throws SQLException, IOException
{
  m_jImgPanel = new IMImagePanel(this,
      m_img, m_imgThumb, m_iProdId, m_colorFieldBg);
  m_jImgPanel.display();
  m_jImgPanel.getAccessibleContext().setAccessibleName
    ("Product photo panel");
  m_jImgPanel.getAccessibleContext().setAccessibleDescription
    ("Product photo panel with an image icon on the left, " +
     "image attribute panel in the middle and image control" +
      "panel on the right.");

  m_jMediaPanel.add(m_jImgPanel);

  Component jImgFocus = m_jImgPanel.getFirstFocusComponent();
}

/**
 * Add the product audio panel.
 */
private void displayAudio() throws SQLException, IOException
{
  m_jAudPanel = new IMAudioPanel(this, m_aud, m_iProdId, m_colorFieldBg);
  m_jAudPanel.display();
  m_jAudPanel.getAccessibleContext().setAccessibleName
    ("Product audio panel");
  m_jAudPanel.getAccessibleContext().setAccessibleDescription(
      "Product audio panel with an audio icon at the left, " +
      "audio attribute panel in the middle and audio control" +
      "panel at the right.");
  m_jMediaPanel.add(m_jAudPanel);
}

/**
 * Add the product video panel.
 */
private void displayVideo() throws SQLException, IOException
{
  m_jVidPanel = new IMVideoPanel(this, m_vid, m_iProdId, m_colorFieldBg);
  m_jVidPanel.display();
  m_jVidPanel.getAccessibleContext().setAccessibleName
    ("Product audio panel");
  m_jVidPanel.getAccessibleContext().setAccessibleDescription(
      "Product audio panel with an video icon at the left, " +
      "video attribute panel in the middle and video control" +
      "panel at the right.");
  m_jMediaPanel.add(m_jVidPanel);
}

/**
 * Add the product testimonials panel.
 */
private void displayDoc() throws SQLException, IOException
```

```
{
  m_jDocPanel = new IMDocPanel(this, m _doc, m_iProdId, m_colorFieldBg);
  m_jDocPanel.display();
  m_jDocPanel.getAccessibleContext().setAccessibleName
    ("Product testimonials panel");
  m_jDocPanel.getAccessibleContext().setAccessibleDescription(
      "Product testimonials panel with an document icon at the left, " +
      "testimonials attribute panel in the middle and testimonials control" +
      "panel at the right.");
  m_jMediaPanel.add(m_jDocPanel);
}
```

See the following sections, respectively, for code examples of the corresponding m_j*Xxx*Panel.display( ) methods, where *Xxx* represents the particular media data type, Img, Aud, Vid, or Doc:

- Operations in the IMImagePanel Class
- Operations in the IMAudioPanel Class
- Operations in the IMVideoPanel Class
- Operations in the IMDocPanel Class

5.2.2 Operations in the IMImagePanel Class

This class displays the image panel, the product photo and its attributes, and the thumbnail image, and lists for reading and writing metadata. What follows is a more detailed description of each of the methods that are defined and what each method does:

- The display( ) method, which first calls the insertProperty( ) method, which calls the Oracle Multimedia image object type methods getMimeType( ), getHeight( ), getWidth( ), and getContentlength( ) to get the attributes of the image to display in a table, and lays out the user interface components for reading and writing image metadata.
- For supported formats, the class displays the product photo thumbnail image, which is generated by calling the IMUtil.generateThumbnail( )method to create the thumbnail image from the product photo.
- The addThumbnail( ) method to show the new thumbnail image.
- The changeThumbnail( ) method to change the thumbnail image.
- The saveToFile( ) method to save the photo to a file.
- The deleteMedia( ) method to delete the product photo image and its thumbnail image from the database by setting the image object type columns to empty using the OrdImage.init( ) method.
- The play( ) media method to show the image using a media player.
- The setMedia( ) method to set the photo and thumbnail object.
- The notExist( ) method checks whether the image data exists and returns true if the BLOB is empty or is not associated with an existing BFILE; otherwise, it returns false.
- The getDataInByteArray( ) method retrieves image data into a byte array by calling the Oracle Multimedia importData( ) method first for the BFILE and returns the results of calling the Oracle Multimedia getDataInByteArray( ) method.

- The refreshPanel( ) method refreshes the display when updating the photo image, attributes, and thumbnail image.
- The getFirstFocusComponent( ) method enforces the correct focus order.
- The emptyPanel( ) method clears the icon and attribute panel.
- The showMetadata( ) method to pop up a window for displaying metadata for the selected type.
- The writeMetadata( ) method to display the write metadata dialog.

The following code example includes the display( ), insertProperty( ), notExist( ), getDataInByteArray( ), and refreshPanel( ) methods, and highlights in bold any SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used:

```
void display() throws IOException, SQLException
{
  addControlPane();

  if (notExist(m_img))
  {
    // The image does not exist.
    m_hasMedia = false;
    layoutEmpty(s_sNotExist);
  }
  else
  {
    m_hasMedia = true;
    // If image exists, try to show the attributes.
    if (insertProperty())
    {
      // Show the thumbnail image.
      // If the thumbnail image does not exist, generate it first.
      if (m_imgThumb != null)
      {
        String sFormat = m_imgThumb.getFormat();

        if (notExist(m_imgThumb) ||
            ( !("JFIF".equalsIgnoreCase(sFormat)) &&
              !("GIFF".equalsIgnoreCase(sFormat))
            ))
        {
          m_imgThumb = IMUtil.generateThumbnail(m_iProdId, m_img, m_imgThumb);
        }

        byte[] thumbnail = getDataInByteArray(m_imgThumb);
        addThumbnail(thumbnail);
      }
      else
      {
        m_imgThumb = IMUtil.generateThumbnail(m_iProdId, m_img, m_imgThumb);
        byte[] thumbnail = getDataInByteArray(m_imgThumb);
        addThumbnail(thumbnail);
      }
    }
  }
}
.
.
```

```
.
  boolean insertProperty() throws SQLException
  {
    boolean isFormatSupported = false;
    String sMimeType = m_img.getMimeType();

    if (sMimeType == null)
      isFormatSupported = IMUtil.setProperties(m_img);
    else
      isFormatSupported = true;

    if (!isFormatSupported)
    {
      layoutEmpty(s_sNotSupported);
    }
    else
    {
      Object[][] data =
      {
        {"MIME Type",  m_img.getMimeType()},
        {"Height", new Integer(m_img.getHeight()).toString()},
        {"Width",  new Integer(m_img.getWidth()).toString()},
        {"Content Length", new Integer(m_img.getContentLength()).toString()}
      };

      .
      .
      .
    }

    return isFormatSupported;
  }
.
.
.
  static boolean notExist(OrdImage img) throws SQLException, IOException
  {
    if (img == null)
      return true;
    else
    {
      if (img.isLocal() && (img.getDataInByteArray() == null))
        return true;
      else if (!img.isLocal() && (":///".equals(img.getSource())))
        return true;
      else
      {
        if (!img.isLocal())
        {
          BFILE bfile = img.getBFILE();
          if (!bfile.fileExists())
            return true;
          else
            return false;
        }
        else
          return false;
      }
    }
  }
```

```
.
.
.
  static byte[] getDataInByteArray(OrdImage img) throws SQLException, IOException
  {
    if (notExist(img))
      return null;
    else
    {
      if (!img.isLocal())
      {
        byte[] ctx[] = new byte[1][4000];
        try
        {
          img.importData(ctx);
        }
        catch (SQLException e)
        {
          new IMMessage(IMConstants.ERROR, "MEDIA_SOURCE_ERR", e);
          return null;
        }
      }
      return img.getDataInByteArray();
    }
  }
.
.
.
  void refreshPanel(boolean isFormatSupported) throws SQLException, IOException
  {
    m_hasMedia = true;
    if (isFormatSupported)
    {
      if (m_jAttrTbl == null)
      {
        m_jAttrPane.remove(m_jEmpty);
        m_jIconPane.remove(m_jIcon);

        byte[] thumbnail = getDataInByteArray(m_imgThumb);
        addThumbnail(thumbnail);

        insertProperty();
      }
      else
      {
        byte[] thumbnail = getDataInByteArray(m_imgThumb);
        changThumbnail(thumbnail);

        m_jAttrTbl.setValueAt(m_img.getMimeType(), 0, 1);
        m_jAttrTbl.setValueAt(new Integer(m_img.getHeight()).toString(), 1, 1);
        m_jAttrTbl.setValueAt(new Integer(m_img.getWidth()).toString(), 2, 1);
        m_jAttrTbl.setValueAt(new Integer(m_img.getContentLength()).toString(),3, 1);
      }
    }
    .
    .
    .
  }
```

5.2.3 Operations in the IMGetMetadataDialog Class

This class shows a dialog to display detailed information for metadata in a product photograph. This class also defines the displayMetadata( ) method and describes what it does.

The displayMetadata( ) method retrieves metadata from the image by using the Oracle Multimedia OrdImage getMetadata( ) method, and then displays the metadata.

The following code example includes the displayMetadata( ) method, and highlights in bold any SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used:

```
private void displayMetadata(String sMetaType)
{
  XMLDocument doc = null;
  try
  {
    //
    // Retrieves the metadata into an XMLType array
    //
    XMLType xmlList[] = m_img.getMetadata(sMetaType);

    if (xmlList.length == 1)
    {
      DOMParser parser = new DOMParser();
      parser.setValidationMode(XMLConstants.NONVALIDATING);
      parser.setPreserveWhitespace(false);
      parser.parse(new StringReader(XMLType.createXML(xmlList[0]).getStringVal()));
      doc = parser.getDocument();
    }
  }
  .
  .
  .
}
```

5.2.4 Operations in the IMPutMetadataDialog Class

This class shows a dialog to write metadata into a product photograph. This class also defines the writeMetadata( ) method and describes what it does.

The writeMetadata( ) method writes XMP metadata into the image metadata by using the Oracle Multimedia OrdImage putMetadata( ) method.

The following code example includes the writeMetadata( ) method, and highlights in bold any SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used:

```
void writeMetadata()
{
  try
  {
    //
    // Let the StringBuffer to hold the XMP packet
    //
    StringBuffer sb = new StringBuffer(
        "<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/\"> "
        );

    String str = null;
    if ( (str=m_jTitleField.getText()) != null)
      sb.append("<dc:title>" + str + "</dc:title>");
    if ( (str=m_jCreatorField.getText()) !=null)
      sb.append("<dc:creator>" + str + "</dc:creator>");
    if ( (str=m_jDateField.getText()) !=null)
      sb.append("<dc:date>" + str + "</dc:date>");
    if ( (str=m_jDescriptionField.getText()) !=null)
      sb.append("<dc:description>" + str + "</dc:description>");
    if ( (str=m_jCopyrightField.getText()) !=null)
      sb.append("<dc:rights>" + str + "</dc:rights>");

    sb.append("</rdf:Description></rdf:RDF></xmpMetadata>");

    XMLType xmp = XMLType.createXML(IMExample.getDBConnection(), sb.toString(),
              "http://xmlns.oracle.com/ord/meta/xmp", true, true);

    //
    // Make sure the image data is local
    //
    if (!m_img.isLocal())
    {
      byte[] ctx[] = new byte[1][4000];
      m_img.importData(ctx);
    }

    //
    // Call Ordimage.putMetadata
    //
    m_img.putMetadata(xmp, "XMP", "utf-8");

    this.dispose();
  }
  .
  .
  .
}
```

5.2.5 Operations in the IMVideoPanel Class

This class displays the video panel, the product video, and its attributes. This class is identical in structure and functions similarly to the `IMImagePanel` class. See Operations in the IMImagePanel Class for descriptions of methods.

The following code example includes the display( ), insertProperty( ), notExist( ), getDataInByteArray( ), and refreshPanel( ) methods, and highlights in bold any SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used:

```
void display() throws IOException, SQLException
{
  addControlPane();

  // Set the video icon.
```

```
    m_jIcon = new JLabel(new ImageIcon(IMExampleFrame.class.getResource("OrdVideo.gif")));
    m_jIcon.setLabelFor(m_jAttrPane);

      m_jIconPane.add(m_jIcon, BorderLayout.CENTER);

    if (notExist())
    {
      // The video does not exist.
      m_hasMedia = false;
      layoutEmpty(s_sNotExist);
    }
    else
    {
      m_hasMedia = true;
      // If the video exists, try to show the attributes.
      insertProperty();
    }
  }
.
.
.
  boolean insertProperty() throws SQLException
  {
    boolean isFormatSupported = false;
    String sMimeType = m_vid.getMimeType();

    if (sMimeType == null)
      isFormatSupported = IMUtil.setProperties(m_vid);
    else
      isFormatSupported = true;

    if (!isFormatSupported)
    {
      layoutEmpty(s_sNotSupported);
    }
    else
    {
      Object[][] data =
      {
        {"MIME Type",  m_vid.getMimeType()},
        {"Height", new Integer(m_vid.getHeight()).toString()},
        {"Width",  new Integer(m_vid.getWidth()).toString()},
        {"Duration", new Integer(m_vid.getVideoDuration()).toString()},
        {"Content Length", new Integer(m_vid.getContentLength()).toString()}
      };
      .
      .
      .
    }

    return isFormatSupported;
  }
.
.
.
  boolean notExist() throws SQLException, IOException
  {
    if (m_vid == null)
      return true;
    else
```

```
    {
      if (m_vid.isLocal() && (m_vid.getDataInByteArray() == null))
        return true;
      else if (!m_vid.isLocal() && (":///".equals(m_vid.getSource())))
        return true;
      else
      {
        if (!m_vid.isLocal())
        {
          BFILE bfile = m_vid.getBFILE();
          if (!bfile.fileExists())
            return true;
          else
            return false;
        }
        else
          return false;
      }
    }
  }
.
.
.
  byte[] getDataInByteArray(OrdVideo vid) throws SQLException, IOException
  {
    if (!m_hasMedia)
      return null;
    else
    {
      if (!vid.isLocal())
      {
        byte[] ctx[] = new byte[1][4000];
        try
        {
          vid.importData(ctx);
        }
        catch (SQLException e)
        {
          new IMMessage(IMConstants.ERROR, "MEDIA_SOURCE_ERR", e);
          return null;
        }
      }
      return vid.getDataInByteArray();
    }
  }
.
.
.
  void refreshPanel(boolean isFormatSupported) throws SQLException, IOException
  {
    m_hasMedia = true;

    if (isFormatSupported)
    {
      if (m_jAttrTbl == null)
      {
        m_jAttrPane.remove(m_jEmpty);
        insertProperty();
      }
      else
```

```
      {
        m_jAttrTbl.setValueAt(m_vid.getMimeType(), 0, 1);
        m_jAttrTbl.setValueAt(new Integer(m_vid.getHeight()).toString(), 1, 1);
        m_jAttrTbl.setValueAt(new Integer(m_vid.getWidth()).toString(), 2, 1);
        m_jAttrTbl.setValueAt(new Integer(m_vid.getVideoDuration()).toString(), 3, 1);
        m_jAttrTbl.setValueAt(new Integer(m_vid.getContentLength()).toString(), 4, 1);
      }
    }
        .
        .
        .
}
```

5.2.6 Operations in the IMAudioPanel Class

This class displays the audio panel, the product audio, and its attributes. This class is identical in structure and functions similarly to the `IMImagePanel` class. See Operations in the IMImagePanel Class for descriptions of methods.

The following code example includes the display( ), insertProperty( ), notExist( ), getDataInByteArray( ), and refreshPanel( ) methods, and highlights in bold any SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used:

```
  void display() throws IOException, SQLException
  {
    addControlPane();

    // Set the audio icon.
    m_jIcon = new JLabel(new ImageIcon(IMExampleFrame.class.getResource("OrdAudio.gif")));
    m_jIcon.setLabelFor(m_jAttrPane);

      m_jIconPane.add(m_jIcon, BorderLayout.CENTER);

    if (notExist())
    {
      // The audio does not exist.
      m_hasMedia = false;
      layoutEmpty(s_sNotExist);
    }
    else
    {
      m_hasMedia = true;

      // If the audio exists, try to show the attributes.
      insertProperty();
    }
  }
.
.
.
  boolean insertProperty() throws SQLException
  {
    boolean isFormatSupported = false;
    String sMimeType = m_aud.getMimeType();

    if (sMimeType == null)
      isFormatSupported = IMUtil.setProperties(m_aud);
    else
```

```
      isFormatSupported = true;

    if (!isFormatSupported)
    {
      layoutEmpty(s_sNotSupported);
    }
    else
    {
      Object[][] data =
      {
        {"MIME Type",  m_aud.getMimeType()},
        {"Duration", new Integer(m_aud.getAudioDuration()).toString()},
        {"Content Length", new Integer(m_aud.getContentLength()).toString()}
      };

      .
      .
      .
    }

    return isFormatSupported;
  }
.
.
.
  boolean notExist() throws SQLException, IOException
  {
    if (m_aud == null)
      return true;
    else
    {
      if (m_aud.isLocal() && (m_aud.getDataInByteArray() == null))
        return true;
      else if (!m_aud.isLocal() && (":///".equals(m_aud.getSource())))
        return true;
      else
      {
        if (!m_aud.isLocal())
        {
          BFILE bfile = m_aud.getBFILE();
          if (!bfile.fileExists())
            return true;
          else
            return false;
        }
        else
          return false;
      }
    }
  }
.
.
.
  byte[] getDataInByteArray(OrdAudio aud) throws SQLException, IOException
  {
    if (!m_hasMedia)
      return null;
    else
    {
      if (!aud.isLocal())
```

```
      {
        byte[] ctx[] = new byte[1][4000];
        try
        {
          aud.importData(ctx);
        }
        catch (SQLException e)
        {
          new IMMessage(IMConstants.ERROR, "MEDIA_SOURCE_ERR", e);
          return null;
        }
      }
      return aud.getDataInByteArray();
    }
  }
.
.
.
  void refreshPanel(boolean isFormatSupported) throws SQLException, IOException
  {
    m_hasMedia = true;
    if (isFormatSupported)
    {
      if (m_jAttrTbl == null)
      {
        m_jAttrPane.remove(m_jEmpty);
        insertProperty();
      }
      else
      {
        m_jAttrTbl.setValueAt(m_aud.getMimeType(), 0, 1);
        m_jAttrTbl.setValueAt(new Integer(m_aud.getAudioDuration()).toString(), 1, 1);
        m_jAttrTbl.setValueAt(new Integer(m_aud.getContentLength()).toString(), 2, 1);
      }
    }
    .
    .
    .
  }
```

5.2.7 Operations in the IMDocPanel Class

This class displays the doc panel, the product testimonials, and its attributes. This class is identical in structure and functions similarly to the `IMImagePanel` class. See Operations in the IMImagePanel Class for descriptions of methods.

The following code example includes the display( ), insertProperty( ), notExist( ), getDataInByteArray( ), and refreshPanel( ) methods, and highlights in bold any SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used:

```
  void display() throws IOException, SQLException
  {
    addControlPane();

    // Set the icon.
    m_jIcon = new JLabel(new ImageIcon(
          IMExampleFrame.class.getResource("OrdDoc.gif")
          ));
```

```
    m_jIcon.setLabelFor(m_jAttrPane);
      m_jIconPane.add(m_jIcon, BorderLayout.CENTER);

    if (notExist())
    {
      // The doc does not exist.
      m_hasMedia = false;
      layoutEmpty(s_sNotExist);
    }
    else
    {
      // If the doc exists, show the attribute table.
      m_hasMedia = true;
      insertProperty();
    }
  }
.
.
.
  boolean insertProperty() throws SQLException
  {
    boolean isFormatSupported = false;
    String sMimeType = m_doc.getMimeType();

    if (sMimeType == null)
      isFormatSupported = IMUtil.setProperties(m_doc);
    else
      isFormatSupported = true;

    if (!isFormatSupported)
    {
      layoutEmpty(s_sNotSupported);
    }
    else
    {
      Object[][] data =
      {
        {"MIME Type",  m_doc.getMimeType()},
        {"Content Length", new Integer(m_doc.getContentLength()).toString()}
      };

     .
     .
     .
    }

    return isFormatSupported;
  }
.
.
.
  boolean notExist() throws SQLException, IOException
  {
    if (m_doc == null)
      return true;
    else
    {
      if (m_doc.isLocal() && (m_doc.getDataInByteArray() == null))
        return true;
      else if (!m_doc.isLocal() && (":///".equals(m_doc.getSource())))
```

```
        return true;
      else
      {
        if (!m_doc.isLocal())
        {
          BFILE bfile = m_doc.getBFILE();
          if (!bfile.fileExists())
            return true;
          else
            return false;
        }
        else
          return false;
      }
    }
  }
.
.
.
  byte[] getDataInByteArray(OrdDoc doc) throws SQLException, IOException
  {
    if (!m_hasMedia)
      return null;
    else
    {
      if (!doc.isLocal())
      {
        byte[] ctx[] = new byte[1][4000];
        try
        {
          doc.importData(ctx, false);
        }
        catch (SQLException e)
        {
          new IMMessage(IMConstants.ERROR, "MEDIA_SOURCE_ERR", e);
          return null;
        }
      }
      return doc.getDataInByteArray();
    }
  }
.
.
.
  void refreshPanel(boolean isFormatSupported) throws SQLException, IOException
  {
    m_hasMedia = true;
    if (isFormatSupported)
    {
      if (m_jAttrTbl == null)
      {
        m_jAttrPane.remove(m_jEmpty);
        insertProperty();
      }
      else
      {
        m_jAttrTbl.setValueAt(m_doc.getMimeType(), 0, 1);
        m_jAttrTbl.setValueAt(new Integer(m_doc.getContentLength()).toString(), 1, 1);
      }
    }
```

```
.
.
.
  }
```

5.2.8 Operations in the IMLoadFile Class

This class loads a media stream from a file to a database for each of the media object types. First, it checks whether this PRODUCT_ID column exists in the PM.ONLINE_MEDIA table and if not, it inserts a new row into the table. Then, it creates and initializes a new media object for each media object type, updates the media data, that is, loads it into the database if it is not already stored there, and finally, sets the media attributes for each media data object.

In this class, the IMFileLoad( ) method calls the initFileChooser( ) method, then the initFileChooser( ) method calls the loadNewMedia( ) method, which does the row insertion and initializing of the media object type columns, and then calls the updateMedia( ) method to update the media and to set the media attributes.

The following code example includes the loadNewMedia( ) and UpdateMedia( ) methods, and highlights in bold any SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used as previously described:

```
private void loadNewMedia()
  throws SQLException, FileNotFoundException, SecurityException, IOException
{
  boolean isInsertNeeded = false;
  String sQuery = null;
  OracleConnection conn = null;
  OracleResultSet rs = null;
  OraclePreparedStatement pstmt = null;

  try
  {
    conn = IMExample.getDBConnection();

    if (m_obj == null)
    {
      // First, check whether or not this product exists in the
      // pm.online_media table. If it exists, isInsertNeeded is set to false;
      // or else, isInsertNeeded is set to true.
      sQuery = new String(
          "select product_id from pm.online_media where product_id = ?");
      pstmt = (OraclePreparedStatement) conn.prepareStatement(sQuery);
      pstmt.setInt(1, m_iProdId);
      rs = (OracleResultSet)pstmt.executeQuery();
      if (rs.next() == false)
        isInsertNeeded = true;
      else
        isInsertNeeded = false;
      rs.close();
      pstmt.close();

      if (isInsertNeeded)
      {
        // If this product is not in the pm.online_media table,
        // insert a row in pm.online_media for this product,
        // and initialize the media object at the same time.
```

```
        sQuery = new String(
            "insert into pm.online_media (product_id, product_photo, " +
            "product_photo_signature, product_thumbnail, product_video, " +
            "product_audio, product_text, product_testimonials) values (" +
            "?, ORDSYS.ORDImage.init(), ORDSYS.ORDImageSignature.init(), " +
            "ORDSYS.ORDImage.init(),  ORDSYS.ORDVideo.init(), " +
            "ORDSYS.ORDAudio.init(), null, ORDSYS.ORDDoc.init())");

        pstmt = (OraclePreparedStatement) conn.prepareCall(sQuery);
        pstmt.setInt(1, m_iProdId);
        pstmt.execute();
        pstmt.close();
      }
    }

  if (!isInsertNeeded)
  {
    // Create a new media object.
    switch (m_iTypeIdentifier)
    {
      case IMG_TYPE:
        sQuery = new String(
            "update pm.online_media set " + m_sColName +
            " = ORDSYS.ORDImage.init() where product_id = ?");
        break;
      case AUD_TYPE:
        sQuery = new String(
            "update pm.online_media set " + m_sColName +
            " = ORDSYS.ORDAudio.init() where product_id = ?");
        break;
      case VID_TYPE:
        sQuery = new String(
            "update pm.online_media set " + m_sColName +
            " = ORDSYS.ORDVideo.init() where product_id = ?");
        break;
      case DOC_TYPE:
        sQuery = new String(
            "update pm.online_media set " + m_sColName +
            " = ORDSYS.ORDDoc.init() where product_id = ?");
        break;
      default:
        new IMMessage(IMConstants.ERROR, "UNKNOWN_TYPE");
        break;
    }

    pstmt = (OraclePreparedStatement) conn.prepareCall(sQuery);
    pstmt.setInt(1, m_iProdId);
    pstmt.execute();
    pstmt.close();
  }

    // At this point, there is a row in the online_media table
    // for this product and the desired media object is initialized.
    // In the following, we update the media object pointer and
    // acquire the right to modify it by selecting again from the
    // database.
    //
    sQuery = new String(
        "select " + m_sColName +
        " from pm.online_media where product_id = ? for update");
```

```
    pstmt = (OraclePreparedStatement) conn.prepareStatement(sQuery);
    pstmt.setInt(1, m_iProdId);
    rs = (OracleResultSet)pstmt.executeQuery();
    if (rs.next() == false)
      throw new SQLException();
    else
    {
      switch (m_iTypeIdentifier)
      {
        case IMG_TYPE:
          m_img = (OrdImage)rs.getORAData(1, OrdImage.getORADataFactory());
          break;
        case AUD_TYPE:
          m_aud = (OrdAudio)rs.getORAData(1, OrdAudio.getORADataFactory());
          break;
        case VID_TYPE:
          m_vid = (OrdVideo)rs.getORAData(1, OrdVideo.getORADataFactory());
          break;
        case DOC_TYPE:
          m_doc = (OrdDoc)rs.getORAData(1, OrdDoc.getORADataFactory());
          break;
        default:
          new IMMessage(IMConstants.ERROR, "UNKNOWN_TYPE");
          break;
      }

      // Update the media object.
      updateMedia();
    }

    rs.close();
    pstmt.close();
  }
  finally
  {
    IMUtil.cleanup(rs, pstmt);
  }
}

/**
 * Update the media and also set the media properties.
 */
private void updateMedia()
  throws SQLException, FileNotFoundException, SecurityException, IOException
{
  String sQuery = null;
  OracleConnection conn = null;
  byte[] ctx[] = new byte[1][64];
  OraclePreparedStatement pstmt = null;

  boolean isFormatSupported = false;

  try
  {
    conn = IMExample.getDBConnection();
    sQuery = new String(
        "update pm.online_media set " + m_sColName +
        " = ? where product_id = ?");
    pstmt = (OraclePreparedStatement) conn.prepareCall(sQuery);
    pstmt.setInt(2, m_iProdId);
```

```
  switch (m_iTypeIdentifier)
  {
    case IMG_TYPE:
      m_img.loadDataFromFile(m_jFileChooser.getText());
      isFormatSupported = IMUtil.setProperties(m_img);
      m_img.setLocal();
      pstmt.setORAData(1, m_img);
      break;
    case AUD_TYPE:
      m_aud.loadDataFromFile(m_jFileChooser.getText());
      isFormatSupported = IMUtil.setProperties(m_aud);
      m_aud.setLocal();
      pstmt.setORAData(1, m_aud);

      // We need to update the media pointer for display,
      // because the input media pointer may be null.
      ((IMAudioPanel)m_parent).setMedia(m_aud);
      ((IMAudioPanel)m_parent).refreshPanel(isFormatSupported);
      break;
    case VID_TYPE:
      m_vid.loadDataFromFile(m_jFileChooser.getText());
      isFormatSupported = IMUtil.setProperties(m_vid);
      m_vid.setLocal();
      pstmt.setORAData(1, m_vid);

      ((IMVideoPanel)m_parent).setMedia(m_vid);
      ((IMVideoPanel)m_parent).refreshPanel(isFormatSupported);
      break;
    case DOC_TYPE:
      m_doc.loadDataFromFile(m_jFileChooser.getText());
      isFormatSupported = IMUtil.setProperties(m_doc);
      m_doc.setLocal();
      pstmt.setORAData(1, m_doc);

      ((IMDocPanel)m_parent).setMedia(m_doc);
      ((IMDocPanel)m_parent).refreshPanel(isFormatSupported);
      break;
    default:
      new IMMessage(IMConstants.ERROR, "UNKNOWN_TYPE");
      break;
  }

  pstmt.execute();
  pstmt.close();

  // Update the thumbnail image.
  if (m_iTypeIdentifier == IMG_TYPE)
  {
    if (isFormatSupported)
      m_imgThumb = IMUtil.generateThumbnail(m_iProdId, m_img, m_imgThumb);

    ((IMImagePanel)m_parent).setMedia(m_img, m_imgThumb);
    ((IMImagePanel)m_parent).refreshPanel(isFormatSupported);
  }
}
finally
{
  IMUtil.cleanup(pstmt);
}
```

```
  }
```

5.2.9 Operations in the IMUtil Class

This class contains common utilities, such as a generateThumbnail( ) static method, wrapper methods for the setProperties( ) methods for each media object type to separate the exceptions caused by unrecognizable formats, and finally, several cleanup methods.

The following code example includes the generateThumbnail( ) method, and highlights in bold any SQL query statements and areas in the code where Oracle Multimedia and other Oracle object types and methods are used:

```
static OrdImage generateThumbnail(int iProdId, OrdImage img, OrdImage imgThumb)
  throws SQLException
  {
    String sQuery = null;
    OracleConnection conn = null;
    OracleResultSet rs = null;
    OraclePreparedStatement pstmt = null;

    try
    {
      conn = IMExample.getDBConnection();

      if (imgThumb == null)
      {
        // The thumbnail media pointer is not initialized.
        // Initialize it first.
        sQuery = new String(
            "update pm.online_media set product_thumbnail = " +
            "ORDSYS.ORDImage.init() where product_id = ?");
        pstmt = (OraclePreparedStatement) conn.prepareCall(sQuery);
        pstmt.setInt(1, iProdId);
        pstmt.execute();
        pstmt.close();

        // Acquire the new pointer and the permission to update.
        sQuery = new String("select product_thumbnail from pm.online_media " +
            "where product_id = ? for update");
        pstmt = (OraclePreparedStatement) conn.prepareStatement(sQuery);
        pstmt.setInt(1, iProdId);
        rs = (OracleResultSet)pstmt.executeQuery();
        if (rs.next() == false)
          throw new SQLException();
        else
          imgThumb = (OrdImage)rs.getORAData(1, OrdImage.getORADataFactory());

        rs.close();
        pstmt.close();
      }

      // Generate the thumbnail image.
      img.processCopy("maxScale=64 64, fileFormat=GIFF", imgThumb);

      // Update the thumbnail image in the database.
      sQuery = new String(
          "update pm.online_media set product_thumbnail = ? where product_id = ?");
      pstmt = (OraclePreparedStatement) conn.prepareCall(sQuery);
```

```
      pstmt.setORAData(1, imgThumb);
      pstmt.setInt(2, iProdId);
      pstmt.execute();
      pstmt.close();

      return imgThumb;
    }
    finally
    {
      IMUtil.cleanup(rs, pstmt);
    }
  }
```

6

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:

6.1 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**.

6.2 Oracle Multimedia Image Metadata Concepts

For a large 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.

6.3 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

6.4 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
- IPTC–IIM
- XMP

6.4.1 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.

6.4.2 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.

6.4.3 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

6.5 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 methods of the ORDImage object type.

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

6.6 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 Section 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:

- Creating a Table for Metadata Storage
- Extracting Image Metadata
- Embedding Image Metadata

6.6.1 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. Each metadata column is bound to its corresponding metadata schema. For example, the `metaEXIF` column is bound to the XML schema stored at `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";
```

6.6.2 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;
```

6.6.3 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;
```

6.7 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/

7

Extending Oracle Multimedia

Oracle Multimedia can be extended to support:

- Other external sources of media data not currently supported
- Other media data formats not currently supported
- A new object type
- 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 chapter includes these sections:

7.1 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 Section 7.1.1.3 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:

7.1.1 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 Section 7.1.1.1 is named ORDX_FILE_SOURCE and the HTTP plug-in described in Section 7.1.1.2 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:

- ORDPLUGINS.ORDX_FILE_SOURCE Package
- ORDPLUGINS.ORDX_HTTP_SOURCE Package
- Extending Oracle Multimedia to Support a New Data Source

7.1.1.1 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 7–1 shows the methods supported in the ORDX_FILE_SOURCE package and the exceptions raised if you call a method that is not supported.

Table 7–1 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
trim	Not supported - raises exception: METHOD_NOT_SUPPORTED
read	Supported
write	Not supported - raises exception: METHOD_NOT_SUPPORTED

7.1.1.2 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 7–2 shows the methods supported in the ORDX_HTTP_SOURCE package and the exceptions raised if you call a method that is not supported.

Table 7–2 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

7.1.1.3 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.

A package body listing is provided in Example 7–1 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 7–1 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;
```

7.2 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 Section 7.2.1.2, Section 7.2.2.2, and Section 7.2.3.2 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
- Supporting Other ORDDoc Data Formats
- Supporting Other Video Data Formats
- Supporting Other Image Data Formats

7.2.1 Supporting Other ORDAudio Data Formats

The following subsections describe how to extend ORDAudio to support other data formats:

- ORDPLUGINS.ORDX_DEFAULT_AUDIO Package
- Extending Oracle Multimedia to Support a New Audio Data Format

7.2.1.1 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 7–3 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 7–3 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.
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.

7.2.1.2 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 Section 7.2.1.1 for a complete description of the interfaces for the ORDX_DEFAULT_AUDIO package. Use the package body example in Example 7–2 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 7–2 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 7–2 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;
```

7.2.2 Supporting Other ORDDoc Data Formats

The following subsections describe how to extend ORDDoc to support other data formats:

- ORDPLUGINS.ORDX_DEFAULT_DOC Package
- Extending Oracle Multimedia to Support a New ORDDoc Data Format

7.2.2.1 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 7–4 shows the method supported in the `ORDPLUGINS.ORDX_DEFAULT_DOC` package and the exception raised if the source is `NULL`.

Table 7–4 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.

7.2.2.2 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 Section 7.2.2.1 for a complete description of the interfaces for the ORDX_DEFAULT_DOC package. Use the package body example in Example 7–3 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 7–3 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 7–3 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;
```

7.2.3 Supporting Other Video Data Formats

The following subsections describe how to extend ORDVideo to support other data formats:

- ORDPLUGINS.ORDX_DEFAULT_VIDEO Package
- Extending Oracle Multimedia to Support a New Video Data Format

7.2.3.1 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 7–5 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 7–5 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

7.2.3.2 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 Section 7.2.3.1 for a complete description of the interfaces for the ORDX_DEFAULT_VIDEO package. Use the package body example in Example 7–4 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 7–4 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 7–4 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;
```

7.2.4 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

7.3 Extending Oracle Multimedia with a New Type

You can use any of the Oracle Multimedia objects types as the basis for a new type of your own creation, as shown in Example 7–5 for the ORDImage object type.

Note: When a type is altered, any dependent type definitions are invalidated. You will encounter this problem if you define a new type that includes an Oracle Multimedia object type attribute and the Oracle Multimedia object type is altered, which always occurs during an Oracle Multimedia installation upgrade.

A workaround to this problem is to revalidate all invalid type definitions with the following SQL statement:

```
SQL> ALTER TYPE <type-name> COMPILE;
```

Example 7–5 Extend Oracle Multimedia ORDImage with a New Object Type

```
CREATE TYPE AnnotatedImage AS OBJECT
    ( image ORDSYS.ORDImage,
      description VARCHAR2(2000),
      MEMBER PROCEDURE SetProperties(SELF IN OUT AnnotatedImage),
      MEMBER PROCEDURE Copy(dest IN OUT AnnotatedImage),
      MEMBER PROCEDURE ProcessCopy(command IN VARCHAR2,
                                   dest IN OUT AnnotatedImage)
    );
/
```

```
CREATE TYPE BODY AnnotatedImage AS
  MEMBER PROCEDURE SetProperties(SELF IN OUT AnnotatedImage) IS
  BEGIN
    SELF.image.setProperties();
    SELF.description :=
        'This is an example of using Image object as a subtype';
  END SetProperties;
  MEMBER PROCEDURE Copy(dest IN OUT AnnotatedImage) IS
  BEGIN
    SELF.image.copy(dest.image);
    dest.description := SELF.description;
  END Copy;
  MEMBER PROCEDURE ProcessCopy(command IN VARCHAR2,
                               dest IN OUT AnnotatedImage) IS
  BEGIN
    SELF.Image.processCopy(command,dest.image);
    dest.description := SELF.description;
  END ProcessCopy;
END;
/
```

After creating the new type, you can use it as you would any other type. For example:

```
CREATE OR REPLACE DIRECTORY ORDIMGDIR AS 'C:\TESTS';

CREATE TABLE my_example(id NUMBER, an_image AnnotatedImage);
INSERT INTO my_example VALUES (1,
    AnnotatedImage(
        ORDSYS.ORDImage.init('file','ORDIMGDIR','plaid.gif'));
COMMIT;
DECLARE
    myimage AnnotatedImage;
BEGIN
    SELECT an_image INTO myimage FROM my_example;
    myimage.SetProperties;
    DBMS_OUTPUT.PUT_LINE('This image has a description of ');
    DBMS_OUTPUT.PUT_LINE(myimage.description);
    UPDATE my_example SET an_image = myimage;
END;
/
```

7.4 Supporting Media Data Processing

Oracle Multimedia also supports the processing of audio and video data, as described in the following subsections:

- Supporting Audio Data Processing
- Supporting Video Data Processing

7.4.1 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

7.4.2 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

8

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 using LOBs in Oracle Database

8.1 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 following tables 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.

Table 8–1 shows the profile for loading and retrieving data, which applies to all Oracle Multimedia media types.

Table 8–1 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

Table 8–2 shows the profile for commonly used methods of the ORDImage type.

Table 8–2 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

Table 8–3 shows the profile for commonly used methods of the ORDDicom type.

Table 8–3 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

Table 8–4 shows the profile for commonly used methods of the ORDAudio and ORDVideo types.

Table 8–4 Performance Profile For ORDAudio 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

8.2 Choosing LOB Storage Parameters for Oracle Multimedia Objects

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:

- SecureFiles LOBs and BasicFiles LOBs
- TABLESPACE
- CACHE, NOCACHE, and CACHE READS
- LOGGING and NOLOGGING
- CHUNK
- Example of Setting LOB Storage Options

See Also:

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

8.2.1 SecureFiles LOBs and BasicFiles LOBs

SecureFiles LOBs (SecureFiles) were introduced in Oracle Database 11*g* Release 1 (11.1) to supplement the original BasicFiles LOBs implementation that is identified by the SQL parameter BASICFILE. The performance of SecureFiles LOBs is significantly better than that of BasicFiles LOBs, especially for large media data. Oracle recommends using SecureFiles LOBs for storing media data whenever possible. SecureFiles LOBs are identified by specifying the SQL parameter SECUREFILE.

8.2.2 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.

8.2.3 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 setProperties( ) method and then generating a thumbnail image), enable read caching for the source media object.

8.2.4 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 with this Data Guard technology.

8.2.5 CHUNK

The CHUNK option applies only to BasicFiles LOBs. It is part of the STORE AS clause, and indicates the size of the minimum unit of storage for the LOB data. CHUNK must be an integer multiple of the block size, and it must have a maximum value of 32K bytes.

Accessing LOBs in bigger chunks is more efficient. For the most efficient storage of media objects, which are almost always much larger than 32K, choose the maximum value of 32K.

8.2.6 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 8–1 through Table 8–4) 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`.

```
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 image 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);
```

8.3 Setting Database Initialization Parameters

Section 8.2 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

9

Oracle Multimedia Examples

This chapter provides examples that show common operations with Oracle Multimedia.

This chapter includes these sections:

9.1 Audio Data Examples

Audio data examples using Oracle Multimedia include common operations on audio data, such as using audio types with object views and using a set of scripts for populating an ORDAudio object with BLOB data stored in the database. The following subsections describe these operations:

- Using Audio Types with Object Views
- Scripts for Populating an ORDAudio Object with BLOB Data

See Also:

Oracle Multimedia Reference for reference information about the methods used in these examples

9.1.1 Using Audio Types with Object Views

This section describes how to use audio types with object views. Just as a view is a virtual table, an object view is a virtual object table.

Oracle provides object views as an extension of the basic relational view mechanism. By using object views, you can create virtual object tables -- of either built-in or user-defined types -- from data stored in the columns of relational or object tables in the database.

Object views can offer specialized or restricted access to the data and objects in a database. For example, you might use an object view to provide a version of an employee object table that does not have attributes containing sensitive data or a deletion method. Object views also let you try object-oriented programming without permanently converting your tables. Using object views, you can convert data gradually and transparently from relational tables to object-relational tables.

In Example 9–1, consider the following relational table (containing no ORDAudio objects).

Example 9–1 Define a Relational Table Containing No ORDAudio Object

```
create table flat (
   id                NUMBER,
   description       VARCHAR2(4000),
   localData         BLOB,
   srcType           VARCHAR2(4000),
   srcLocation       VARCHAR2(4000),
   srcName           VARCHAR2(4000),
   upDateTime        DATE,
   local             NUMBER,
   format            VARCHAR2(31),
   mimeType          VARCHAR2(4000),
   comments          CLOB,
   encoding          VARCHAR2(256),
   numberOfChannels  NUMBER,
   samplingRate      NUMBER,
   sampleSize        NUMBER,
   compressionType   VARCHAR2(4000),
   audioDuration     NUMBER,
)
--
-- Store audio data as SecureFiles LOBs.
--
LOB(localData) STORE AS SECUREFILE;
```

You can create an object view on the relational table shown in Example 9–1, as shown in Example 9–2.

Example 9–2 Define an Object View Containing an ORDAudio Object and Relational Columns

```
create or replace view object_audio_v as
  select
      id,
      ORDSYS.ORDAudio(T.description,
      ORDSYS.ORDSource(
         T.localData, T.srctype, T.srcLocation, T.srcName, T.updateTime,
         T.local),
         T.format,
         T.mimeType,
         T.comments,
         T.encoding,
         T.numberOfChannels,
         T.samplingRate,
         T.sampleSize,
         T.compressionType,
         T.audioDuration)
   from flat T;
```

Object views provide the flexibility of looking at the same relational or object data in more than one way. Therefore, you can use different in-memory object representations for different applications without changing the way you store the data in the database.

See Also:

Oracle Database Concepts for more information about defining, using, and updating object views

9.1.2 Scripts for Populating an ORDAudio Object with BLOB Data

The scripts presented in this section demonstrate how to populate an Oracle Multimedia ORDAudio object from an existing BLOB stored in the database.

Table 9–1 lists each script by name, along with a brief description of the operations it performs. Each script is included and described in further detail in the following sections.

Table 9–1 Audio Scripts

Script Name	Operations Performed
`create_mediadir.sql` (See Example 9–3)	Creates an audio data load directory. (See Section 9.1.2.1)
`create_soundtable.sql` (See Example 9–4)	Creates and populates the `soundtable` table. (See Section 9.1.2.2)
`create_audtable.sql` (See Example 9–5)	Creates the `audio_table` table. (See Section 9.1.2.3)
`import_aud.sql` (See Example 9–6)	Loads the audio data. This script imports the audio data from an audio file into the `audio_table` table using the ORDAudio import( ) method. (See Section 9.1.2.4)
`copy_audblob.sql` (See Example 9–7)	Copies the BLOB data from the `soundtable` table to the `audio_table` table. (See Section 9.1.2.5)
`showprop_aud.sql` (See Example 9–8)	Displays the properties of the loaded audio data stored in the `audio_table` table. (See Section 9.1.2.6)
`setup_audsample.sql` (See Example 9–9)	Automates the process by running the previous audio scripts in the required order. (See Section 9.1.2.7)
`cleanup_audsample.sql` (See Example 9–10)	Cleans up by removing the sample tables, directories, and procedures from your database. (See Section 9.1.2.8)

9.1.2.1 Create an Audio Data Load Directory

The `create_mediadir.sql` script creates the audio data load directory. This script is shown in Example 9–3. (See Section 9.2.1.1 and Section 9.3.1.1, respectively, for information about how to use this script to create the load directories for media data and image data.)

To load the audio data successfully, you must create a database directory object that points to a file directory on your system. Example 9–3 uses the `media_dir` directory, which points to the file directory `C:\media_dir`. You can edit the `create_mediadir.sql` script to replace the directory path in the CREATE OR REPLACE DIRECTORY statement with your directory specification.

This directory specified in the create_mediadir.sql script must contain your sample audio files. The audio examples use the sample file aud1.wav, which is installed in the <ORACLE_HOME>/ord/aud/demo directory. You can copy any supported audio files to the C:\media_dir directory to run the scripts in these examples.

Before running the create_mediadir.sql script, ensure that you have these privileges:

- CREATE ANY DIRECTORY (to specify the directory specification for your audio files)
- DROP ANY DIRECTORY (to delete previous instances of the audio data load directory)

Note: If you run the create_mediadir.sql script as a different user than the user who ran the other audio scripts, you must perform these steps:

1. Uncomment the GRANT READ ON DIRECTORY statement.
2. Replace the string <USER> in this statement with the new user (for example: SCOTT).

Example 9–3 create_mediadir.sql Script

```
-- create_mediadir.sql
--
SET SERVEROUTPUT ON;
SET ECHO ON;

-- To delete the directory, uncomment the next statement;
-- otherwise, leave it commented out.
-- DROP DIRECTORY media_dir;

-- To specify a different directory path, replace the default directory
-- path with the new path in the next statement.
CREATE OR REPLACE DIRECTORY media_dir AS 'C:\media_dir';

-- To change the user, uncomment the next statement and replace the
-- string "<USER>" with the new user. Otherwise, leave the statement
-- commented out.
-- GRANT READ ON DIRECTORY media_dir TO <USER>;
```

9.1.2.2 Create and Populate the soundtable Table

The create_soundtable.sql script creates and populates the soundtable table. This table contains a BLOB column; it is created to demonstrate how to populate a table with an Oracle Multimedia ORDAudio column from a table with a BLOB column. This script is shown in Example 9–4.

This script creates the soundtable table, inserts a row with an empty BLOB, loads the BLOB with audio data, and then checks the length of the BLOB data. You can replace the name of the data file in the create_soundtable.sql script with the name of the data file you plan to use.

Before running this script, ensure that you have the CREATE TABLE privilege.

Example 9–4 create_soundtable.sql Script

```
-- create_soundtable.sql
--
-- Create the soundtable table. This table is used ONLY to show
```

```
-- how to copy data from a BLOB column to an ORDAudio column.
--
-- Insert a row into the table with an empty BLOB.
-- Load the row with BLOB data by pointing to the audio file to
-- be loaded from the directory specified using the BFILE data
-- type.
-- Close the files and commit the transaction.
-- Check the length of the BLOB loaded. Is the length
-- what you are expecting?
--
SET SERVEROUTPUT ON;

CREATE TABLE soundtable ( id number,
                          sound BLOB default EMPTY_BLOB() )
--
-- Store audio data as SecureFiles LOBs.
--
LOB(sound) STORE AS SECUREFILE;

--
INSERT INTO soundtable(id, sound) VALUES (1, EMPTY_BLOB());
COMMIT;

DECLARE
   f_lob BFILE := BFILENAME('MEDIA_DIR','aud1.wav');
   b_lob BLOB;
   length INTEGER;
BEGIN

  SELECT sound INTO b_lob FROM soundtable WHERE id=1 FOR UPDATE;

  -- Open the LOBs.
  dbms_lob.open(f_lob, dbms_lob.file_readonly);
  dbms_lob.open(b_lob, dbms_lob.lob_readwrite);

  -- Populate the BLOB from the 'aud1.wav' file in the BFILE.
  dbms_lob.loadfromfile (b_lob, f_lob, dbms_lob.getlength(f_lob));

  -- Close the LOBs.
  dbms_lob.close(b_lob);
  dbms_lob.close(f_lob);
  COMMIT;

  -- Check the length of the LOB.
  SELECT dbms_lob.getlength(t.sound) INTO length FROM soundtable t WHERE id = 1;
  DBMS_OUTPUT.PUT_LINE('The length is '|| length);
END;
/
```

9.1.2.3 Create the audio_table Table

The `create_audtable.sql` script creates the `audio_table` table with the two columns `id` and `audio`. The `audio` column is defined as type ORDAudio. This script is shown in Example 9–5.

Before running this script, ensure that you have the CREATE TABLE privilege.

Example 9–5 create_audtable.sql Script

```
-- create_audtable.sql
--
```

```
CREATE TABLE audio_table ( id NUMBER,
                        audio ORDAudio )
LOB(audio.source.localData) STORE AS SECUREFILE;
```

9.1.2.4 Load the Audio Data

The `import_aud.sql` script inserts a row into the `audio_table` table, and imports audio data from an audio file into the `audio` column in the `audio_table` table using the ORDAudio import( ) method. This script is shown in Example 9–6.

To run this script successfully, you must copy one audio clip to your `media_dir` directory using the name specified in this script, or modify this script to match the file names of your audio clips.

This script loads the same audio clip that was loaded by the `create_soundtable.sql` script. It is used later in the `showprop_aud.sql` script to show that data loaded with the import( ) method matches the data copied from the BLOB column of the `soundtable` table.

> **Note:** Run this script as the user who ran the previous audio scripts.

Example 9–6 import_aud.sql Script

```
--import_aud.sql
--
DECLARE
  obj ORDAUDIO;
  ctx RAW(64) := NULL;

BEGIN

  -- Insert a row with an ORDAudio object.
  INSERT INTO audio_table VALUES
    (1, ORDAudio('FILE', 'MEDIA_DIR', 'aud1.wav'))
    returning audio into obj;

  --Import the audio clip aud1.wav from media_dir.
  obj.import(ctx);

  --Set the properties.
  obj.setProperties(ctx);

  --Update the table with the audio object.
  UPDATE audio_table SET audio = obj WHERE id = 1;

  COMMIT;

END;
/
```

9.1.2.5 Copy the BLOB Data to the ORDAudio Object

The `copy_audblob.sql` script inserts a row with `id=2` into the `audio_table` table and copies the audio data in the `sound` column of the `soundtable` table into the `audio` column of the `audio_table` table for a row with `id=2`. The script uses the ORDAudio constructor that takes a BLOB as the input parameter. It also sets the properties of the audio data after inserting it. This script is shown in Example 9–7.

Note: Run this script as the user who ran the previous audio scripts.

Example 9–7 copy_audblob.sql Script

```
--copy_audblob.sql
--
-- Use the ORDAudio constructor that takes a BLOB as the input parameter
-- in the SQL INSERT statement.
--
-- In this case, the BLOB (an audio clip), which was stored in
-- a row with ID = 1 in the soundtable table, is copied to a row
-- with ID = 2 in the audio_table table containing an audio column
-- defined as an ORDAudio object type.
--
INSERT INTO audio_table
  (select 2, ORDAudio(S.sound) FROM soundtable S WHERE S.id = 1);

DECLARE
 obj ORDSYS.ORDAudio;
 ctx RAW(40) := NULL;
BEGIN
SELECT audio INTO obj FROM audio_table WHERE id = 2 for update;
obj.setProperties(ctx);
UPDATE audio_table SET audio = obj WHERE ID = 2;
END;
/

COMMIT;
```

9.1.2.6 Show the Properties of the Loaded Audio Data

The `showprop_aud.sql` script displays the properties of the audio data clips stored in the `audio_table` table. They should be identical. Different load methods were used to load the same audio clip into two rows in the `audio_table` table. This script verifies that the audio data that was loaded using the ORDAudio import( ) method matches the audio data that was copied from a BLOB column of the `soundtable` table. This script is shown in Example 9–8.

Note: Run this script as the user who ran the previous audio scripts.

Example 9–8 showprop_aud.sql Script

```
-- showprop_aud.sql
--
SET SERVEROUTPUT ON;

--
--Query audio_table for ORDAudio content in PL/SQL.
--

BEGIN
  -- Check the properties of the audio data clip imported into the
  -- ORDAudio object type. Properties for ID=1 should be identical
  -- with ID=2.

  dbms_output.put_line(' Properties of these audio clips are identical:');

  FOR rec in (SELECT id, audio FROM audio_table ORDER BY id) LOOP
```

```
    dbms_output.put_line('Properties for id: ' || rec.id);

    dbms_output.put_line('audio encoding: ' || rec.audio.getEncoding);
    dbms_output.put_line('audio number of channels: '||
                        rec.audio.getNumberOfChannels);
    dbms_output.put_line('audio MIME type: ' || rec.audio.getMimeType);
    dbms_output.put_line('audio file format: ' || rec.audio.getFormat);
    dbms_output.put_line
        ('-----------------------------------------------');
  END LOOP;
END;
/
--
-- Query audio_table for ORDAudio and list the properties using SQL.
--
clear columns
column id       format 99;
column encoding format a15;
column mimetype   format a20;
column fileformat   format a15;
column channels     format 99;
SELECT t.id,
       t.audio.getEncoding() encoding,
       t.audio.getNumberOfChannels() channels,
       t.audio.getMimetype() mimetype,
       t.audio.getFormat() fileformat
from audio_table t ORDER BY t.id;
```

The results from running the script `showprop_aud.sql` show that the properties are identical for each stored audio clip.

```
Properties of these audio clips are identical:
Properties for id: 1
audio encoding: MS_PCM
audio number of channels: 1
audio MIME type: audio/x-wav
audio file format: WAVE
-----------------------------------------------
Properties for id: 2
audio encoding: MS_PCM
audio number of channels: 1
audio MIME type: audio/x-wav
audio file format: WAVE
-----------------------------------------------

PL/SQL procedure successfully completed.


ID ENCODING        CHANNELS MIMETYPE             FILEFORMAT
--- --------------- -------- -------------------- ---------------
  1 MS_PCM                 1 audio/x-wav          WAVE
  2 MS_PCM                 1 audio/x-wav          WAVE
```

9.1.2.7 Automate the ORDAudio Examples

The `setup_audsample.sql` script runs each of the previous audio scripts in the correct order to automate this process. This script is shown in Example 9–9.

Before running this script, ensure that you have these privileges:

- CREATE ANY DIRECTORY

- CREATE TABLE

Example 9–9 setup_audsample.sql Script

```
-- setup_audsample.sql
--

-- Create the media_dir load directory:
@create_mediadir.sql

-- Create the soundtable table and populate it with
-- an audio clip:
@create_soundtable.sql

-- Create the audio_table table:
@create_audtable.sql

--Import an audio clip:
@import_aud.sql

-- Copy a BLOB into an ORDAudio object, set the properties,
-- and update the time:
@copy_audblob.sql

-- Check the properties of the audio clips. The properties
-- should be identical:
@showprop_aud.sql

--exit;
```

9.1.2.8 Clean Up the ORDAudio Examples

The `cleanup_audsample.sql` script removes the sample tables, directories, and procedures created by the previous audio scripts from your database. This script is shown in Example 9–10.

Before running this script, ensure that you have the DROP ANY DIRECTORY privilege.

> **Note:** Run this script as the user who ran the previous audio scripts.

Example 9–10 cleanup_audsample.sql Script

```
-- cleanup_audsample.sql
--
-- Drop the audio load directory.
-- DROP DIRECTORY media_dir;

-- Drop the tables created by the demo.
DROP TABLE soundtable PURGE;
DROP TABLE audio_table PURGE;

exit;
```

9.2 Media Data Examples

Media data examples using Oracle Multimedia include common operations on heterogeneous data, such as using a set of scripts for populating an ORDDoc object from a file data source. The following subsection describes this operation:

- Scripts for Populating an ORDDoc Object from a File Data Source

See Also:

Oracle Multimedia Reference for reference information about the methods used in these examples

9.2.1 Scripts for Populating an ORDDoc Object from a File Data Source

The scripts presented in this section demonstrate how to populate an ORDDoc object from an existing file.

Table 9–2 lists each script by name, along with a brief description of the operations it performs. Each script is included and described in further detail in the following sections.

Table 9–2 Media Scripts

Script Name	Operations Performed
`create_mediadir.sql` (See Example 9–3)	Creates a media data load directory. (See Section 9.2.1.1)
`create_doctable.sql` (See Example 9–11)	Creates the `doc_table` table. (See Section 9.2.1.2)
`import_doc.sql` (See Example 9–12)	Loads the media data. This script imports the media data from a file into the `doc_table` table using the ORDDoc import( ) method. (See Section 9.2.1.3)
`read_doc.sql` (See Example 9–13)	Reads the media data from a BLOB using a stored procedure. (See Section 9.2.1.4)
`showprop_doc.sql` (See Example 9–14)	Displays the properties of the loaded media data stored in the `doc_table` table. (See Section 9.2.1.5)
`setup_docsample.sql` (See Example 9–15)	Automates the process by running the previous media scripts in the required order. (See Section 9.2.1.6)
`cleanup_docsample.sql` (See Example 9–16)	Cleans up by removing the sample tables, directories, and procedures from your database. (See Section 9.2.1.7)

9.2.1.1 Create a Media Data Load Directory

The `create_mediadir.sql` script creates the media data load directory. This script is shown in Example 9–3.

To load the media data successfully, you must create a database directory object that points to a file directory on your system. Example 9–3 uses the `media_dir` directory, which points to the file directory `C:\media_dir`. You can edit the `create_mediadir.sql` script to replace the directory path in the CREATE OR REPLACE DIRECTORY statement with your directory specification.

This directory specified in the `create_mediadir.sql` script must contain your sample media files. The media examples use the sample files `aud1.wav` and `aud2.mp3`, which are installed in the *<ORACLE_HOME>*`/ord/aud/demo` directory. You can copy any

supported media files to the C:\media_dir directory to run the scripts in these examples.

Before running the create_mediadir.sql script, ensure that you have these privileges:

- CREATE ANY DIRECTORY (to specify the directory specification for your media files)
- DROP ANY DIRECTORY (to delete previous instances of the media data load directory)

> **Note:** If you run the create_mediadir.sql script as a different user than the user who ran the other media scripts, you must perform these steps:
>
> 1. Uncomment the GRANT READ ON DIRECTORY statement.
> 2. Replace the string <USER> in this statement with the new user (for example: SCOTT).

9.2.1.2 Create the doc_table Table

The create_doctable.sql script creates the doc_table table with the two columns id and document. The document column is defined as type ORDDoc. This script is shown in Example 9–11.

Before running this script, ensure that you have the CREATE TABLE privilege.

Example 9–11 create_doctable.sql Script

```
-- create_doctable.sql
--
CREATE TABLE doc_table ( id NUMBER,
                         document ORDDoc )
LOB(document.source.localData) STORE AS SECUREFILE;
```

9.2.1.3 Load the Media Data

The import_doc.sql script inserts two rows into the doc_table table, and imports media data from a media file into the document column in the doc_table table using the ORDDoc import( ) method. This script is shown in Example 9–12.

To run this script successfully, you must copy two media files to your media_dir directory using the names specified in this script, or modify this script to match the file names of your media files.

> **Note:** Run this script as the user who ran the previous media scripts.

Example 9–12 import_doc.sql Script

```
-- import_doc.sql
--
CREATE OR REPLACE PROCEDURE load_document (in_id INTEGER,
                                           in_dir VARCHAR2,
                                           in_fname VARCHAR2)
AS
  obj ORDDOC;
  ctx RAW(64) := NULL;
BEGIN
  INSERT INTO doc_table VALUES
```

```
    (in_id, ORDDoc('FILE', in_dir, in_fname))
    RETURNING document INTO obj;
  obj.import(ctx,TRUE);
  UPDATE doc_table SET document = obj WHERE id = in_id;
  COMMIT;
END;
/
show errors;

-- Import the audio files aud1.wav and aud2.mp3 from the MEDIA_DIR directory
-- on a local file system.
EXECUTE load_document(1, 'MEDIA_DIR', 'aud1.wav');
EXECUTE load_document(2, 'MEDIA_DIR', 'aud2.mp3');
```

9.2.1.4 Read the Media Data from the BLOB

The `read_doc.sql` script reads media data from a BLOB by creating the stored procedure `read_document`. This procedure reads a specified amount of media data from the BLOB attribute, beginning at a particular offset, until all the media data is read. This script is shown in Example 9–13.

> **Note:** Run this script as the user who ran the previous media scripts.

Example 9–13 read_doc.sql Script

```
--read_doc.sql
--
SET SERVEROUTPUT ON

create or replace procedure read_document( in_id integer) as
obj ORDDoc;
buffer RAW (32767);
numBytes integer;
bytesRead integer := 0;
startpos integer := 1;
ctx RAW(64) := NULL;
BEGIN
  select document into obj from doc_table where id = in_id;
  DBMS_OUTPUT.PUT_LINE('Content length is: ' || obj.getContentLength());

  LOOP
    numBytes := 32767;
    startpos := startpos + bytesRead;
    obj.readFromSource(ctx,startPos,numBytes,buffer);
    bytesRead := numBytes;

    DBMS_OUTPUT.PUT_LINE('start position: '|| startPos);
    DBMS_OUTPUT.PUT_LINE('read ' || bytesRead || ' bytes.');

   -- Note: Add your own code here to process the media data being read.
   -- This routine reads the data into the buffer 32767 bytes at a time,
   -- then reads the next chunk, overwriting the first buffer full of data.
 END LOOP;
 EXCEPTION
     WHEN NO_DATA_FOUND THEN
       DBMS_OUTPUT.PUT_LINE('End of data ');
     WHEN ORDSYS.ORDSourceExceptions.METHOD_NOT_SUPPORTED THEN
       DBMS_OUTPUT.PUT_LINE('ORDSourceExceptions.METHOD_NOT_SUPPORTED caught');
     WHEN OTHERS THEN
```

```
       DBMS_OUTPUT.PUT_LINE('EXCEPTION caught:' || SQLERRM);
END;
/
show errors
```

To execute the stored procedure, enter the following SQL statements:

```
SQL> set serveroutput on;
SQL> execute read_document(1);

Content length is: 93594
start position: 1
read 32767 bytes.
start position: 32768
read 32767 bytes.
start position: 65535
read 28060 bytes.
End of data

PL/SQL procedure successfully completed.
```

9.2.1.5 Show the Properties of the Loaded Media Data

The `showprop_doc.sql` script displays the properties of the media data loaded into the `doc_table` table. This script is shown in Example 9–14.

> **Note:** Run this script as the user who ran the previous media scripts.

Example 9–14 showprop_doc.sql Script

```
-- showprop_doc.sql
--
SET SERVEROUTPUT ON;

--
-- Query doc_table for ORDDoc and print the properties using PL/SQL.
--

BEGIN
  FOR rec in (SELECT id, document FROM doc_table ORDER BY id) LOOP
    dbms_output.put_line('document id: '|| rec.id);
    dbms_output.put_line('document MIME type: '|| rec.document.getMimeType());
    dbms_output.put_line('document file format: '|| rec.document.getFormat());
    dbms_output.put_line('BLOB Length: '|| rec.document.getContentLength());
    dbms_output.put_line('-----------------------------------------------');
  END loop;
END;
/

--
-- Query doc_table for ORDDoc and list the properties using SQL.
--
clear columns
column id    format 99;
column mimetype format a20;
column format   format a10;
column length   format 99999999;
SELECT t.id,
       t.document.getMimeType() mimetype,
       t.document.getFormat() format,
```

```
      t.document.getContentLength() length
from doc_table t ORDER BY t.id;
```

The results from running the script `showprop_doc.sql` are the following:

```
SQL> @showprop_doc.sql

document id: 1
document MIME type: audio/x-wav
document file format: WAVE
BLOB Length: 93594
-----------------------------------------------
document id: 2
document MIME type: audio/mpeg
document file format: MPGA
BLOB Length: 51537
-----------------------------------------------

PL/SQL procedure successfully completed.


 ID MIMETYPE             FORMAT        LENGTH
--- -------------------- ---------- ---------
  1 audio/x-wav          WAVE           93594
  2 audio/mpeg           MPGA           51537
```

9.2.1.6 Automate the ORDDoc Examples

The `setup_docsample.sql` script runs each of the previous media scripts in the correct order to automate this process. This script is shown in Example 9–15.

Before running this script, ensure that you have these privileges:

- CREATE ANY DIRECTORY
- CREATE TABLE

Example 9–15 setup_docsample.sql Script

```
-- setup_docsample.sql
--

-- Create the media_dir load directory:
@create_mediadir.sql

-- Create the doc_table table:
@create_doctable.sql

--Import 2 media clips and set the properties:
@import_doc.sql

--Display the properties of the media clips:
@showprop_doc.sql

--Create a stored procedure to read from ordDoc:
@read_doc.sql

--Execute the stored procedure:
execute read_document(1);

--exit;
```

9.2.1.7 Clean Up the ORDDoc Examples

The `cleanup_docsample.sql` script removes the sample tables, directories, and procedures created by the previous media scripts from your database. This script is shown in Example 9–16.

Before running this script, ensure that you have the DROP ANY DIRECTORY privilege.

> **Note:** Run this script as the user who ran the previous media scripts.

Example 9–16 cleanup_docsample.sql Script

```
-- cleanup_docsample.sql
--
-- Drop the doc load directory.
-- DROP DIRECTORY media_dir;

-- Drop the table and procedures created by the demo.
DROP TABLE doc_table PURGE;
DROP PROCEDURE read_document;
DROP PROCEDURE load_document;

exit;
```

9.3 Image Data Examples

Image data examples using Oracle Multimedia include common operations on image data, such as using a set of scripts for populating an ORDImage object from a file data source, using a set of scripts for loading an image table from an HTTP data source, and addressing issues related to globalization support. The following subsections describe these operations:

- Scripts for Populating an ORDImage Object from a File Data Source
- Loading an Image Table from an HTTP Data Source
- Addressing Globalization Support Issues

> **See Also:**
>
> *Oracle Multimedia Reference* for reference information about the methods used in these examples

9.3.1 Scripts for Populating an ORDImage Object from a File Data Source

The scripts presented in this section demonstrate how to populate an Oracle Multimedia ORDImage object from an existing file.

Table 9–3 lists each script by name, along with a brief description of the operations it performs. Each script is included and described in further detail in the following sections.

Table 9–3 Image Scripts

Script Name	Operations Performed
`create_mediadir.sql` (See Example 9–3)	Creates an image data load directory. (See Section 9.3.1.1)

Table 9–3 (Cont.) Image Scripts

Script Name	Operations Performed
create_imgtable.sql (See Example 9–17)	Creates the image_table table. (See Section 9.3.1.2)
import_img.sql (See Example 9–18)	Loads the image data. This script imports the image data from a file into the image_table table using the ORDImage import( ) method. (See Section 9.3.1.3)
read_image.sql (See Example 9–19)	Reads the image data from a BLOB using a stored procedure. (See Section 9.3.1.4)
showprop_img.sql (See Example 9–20)	Displays the properties of the loaded image data stored in the image_table table. (See Section 9.3.1.5)
setup_imgsample.sql (See Example 9–21)	Automates the process by running the previous image scripts in the required order. (See Section 9.3.1.6)
cleanup_imgsample.sql (See Example 9–22)	Cleans up by removing the sample tables, directories, and procedures from your database. (See Section 9.3.1.7)

9.3.1.1 Create an Image Data Load Directory

The create_mediadir.sql script creates the image data load directory. This script is shown in Example 9–3.

To load the image data successfully, you must create a database directory object that points to a file directory on your system. Example 9–3 uses the media_dir directory, which points to the file directory C:\media_dir. You can edit the create_mediadir.sql script to replace the directory path in the CREATE OR REPLACE DIRECTORY statement with your directory specification.

This directory specified in the create_mediadir.sql script must contain your sample image files. The image examples use the sample files img71.gif and img50.gif, which are installed in the <*ORACLE_HOME*>/ord/img/demo directory. You can copy any supported image files to the C:\media_dir directory to run the scripts in these examples.

Before running the create_mediadir.sql script, ensure that you have these privileges:

- CREATE ANY DIRECTORY (to specify the directory specification for your image files)
- DROP ANY DIRECTORY (to delete previous instances of the image data load directory)

Note: If you run the create_mediadir.sql script as a different user than the user who ran the other image scripts, you must perform these steps:

1. Uncomment the GRANT READ ON DIRECTORY statement.
2. Replace the string <USER> in this statement with the new user (for example: SCOTT).

9.3.1.2 Create the image_table Table

The `create_imgtable.sql` script creates the `image_table` table with the two columns `id` and `image`. The `image` column is defined as type ORDImage. This script is shown in Example 9–17.

Before running this script, ensure that you have the CREATE TABLE privilege.

Example 9–17 create_imgtable.sql Script

```
-- create_imgtable.sql
--
CREATE TABLE image_table ( id NUMBER,
                           image ORDImage )
LOB(image.source.localData) STORE AS SECUREFILE;
```

9.3.1.3 Load the Image Data

The `import_img.sql` script inserts two rows into the `image_table` table, and imports image data from an image file into the `image` column in the `image_table` table using the ORDImage import( ) method. This script is shown in Example 9–18.

To run this script successfully , you must copy two image files to your `media_dir` directory using the file names specified in this script, or modify this script to match the file names of your image files.

> **Note:** Run this script as the user who ran the previous image scripts.

Example 9–18 import_img.sql Script

```
-- import_img.sql
--
CREATE OR REPLACE PROCEDURE load_image(in_id INTEGER,
                                       in_dir VARCHAR2,
                                       in_fname VARCHAR2)
AS
  obj ORDIMAGE;
  ctx RAW(64) := NULL;
BEGIN
  INSERT INTO image_table VALUES
      (in_id, ORDImage('FILE', in_dir, in_fname))
      RETURNING image INTO obj;
  obj.import(ctx);
  UPDATE image_table SET image = obj WHERE id = in_id;
  COMMIT;
END;
/
show errors

-- Import the two files into the database.
EXECUTE load_image(1, 'MEDIA_DIR', 'img71.gif');
EXECUTE load_image(2, 'MEDIA_DIR', 'img50.gif');
```

9.3.1.4 Read the Image Data from the BLOB

The `read_image.sql` script reads image data from a BLOB by creating the stored procedure `read_image`. This procedure reads a specified amount of image data from the BLOB attribute, beginning at a particular offset, until all the image data is read. This script is shown in Example 9–19.

Note: Run this script as the user who ran the previous image scripts.

Example 9–19 read_image.sql Script

```
-- read_image.sql
--
set serveroutput on
create or replace procedure read_image (in_id integer) as
-- Note: ORDImage has no readFromSource method like ORDAudio
-- and ORDVideo; therefore, you must use the DBMS_LOB package to
-- read image data from a BLOB.
buffer RAW (32767);
src BLOB;
amt integer;
pos integer := 1;
bytesRead integer := 0;
length integer;
BEGIN
  Select t.image.getcontent(), t.image.getContentLength()
    into src, length from image_table t where t.id = in_id;
  DBMS_OUTPUT.PUT_LINE('Content length is: '|| length);

  LOOP
    amt := 32767;
    pos := pos + bytesRead;
    DBMS_LOB.READ(src,amt,pos,buffer);
    bytesRead := amt;

    DBMS_OUTPUT.PUT_LINE('start position: '|| pos);
    DBMS_OUTPUT.PUT_LINE('bytes read '|| bytesRead);
-- Note: Add your own code here to process the image data being read.
-- This routine reads data into the buffer 32767 bytes at a time,
-- then reads the next chunk, overwriting the first buffer full of data.
  END LOOP;
  EXCEPTION
  WHEN NO_DATA_FOUND THEN
    DBMS_OUTPUT.PUT_LINE('----------------');
    DBMS_OUTPUT.PUT_LINE('End of data ');
END;
/
show errors
```

To execute the stored procedure, enter the following SQL statements:

```
SQL> set serveroutput on;
SQL> execute read_image(1);
Content length is: 1124
start position: 1
bytes read 1124
----------------
End of data

PL/SQL procedure successfully completed.
```

9.3.1.5 Show the Properties of the Loaded Image Data

The `showprop_img.sql` script displays the properties of the image data loaded into the `image_table` table. This script is shown in Example 9–20.

Note: Run this script as the user who ran the previous image scripts.

Example 9–20 showprop_img.sql Script

```
-- showprop_img.sql
--
SET SERVEROUTPUT ON;

--
-- Display the properties of the images stored in image_table using PL/SQL.
--

BEGIN

  FOR rec in (SELECT id, image from image_table ORDER BY id) LOOP
    dbms_output.put_line('Image properties:');
    dbms_output.put_line('image id: '|| rec.id);
    dbms_output.put_line('image height: '|| rec.image.getHeight());
    dbms_output.put_line('image width: '|| rec.image.getWidth());
    dbms_output.put_line('image MIME type: '|| rec.image.getMimeType());
    dbms_output.put_line('image file format: '|| rec.image.getFileFormat());
    dbms_output.put_line('BLOB Length: '|| rec.image.getContentLength());
    dbms_output.put_line('-----------------------------------------');
  END loop;
END;
/

--
-- Display the properties of the images stored in image_table using SQL.
--
clear columns
column id        format 99;
column height    format 999999;
column width     format 999999;
column mimetype  format a15;
column fileformat format a10;
column length     format 999999999;
select t.id,
       t.image.getHeight() height,
       t.image.getWidth() width,
       t.image.getMimetype() mimetype,
       t.image.getFileFormat() fileformat,
       t.image.getContentLength() length
from image_table t ORDER BY t.id;
```

The results from running the script `showprop_img.sql` are the following:

```
SQL> @showprop_img.sql
Image properties:
image id: 1
image height: 15
image width: 43
image MIME type: image/gif
image file format: GIFF
BLOB Length: 1124
-----------------------------------------
Image properties:
image id: 2
image height: 32
```

```
image width: 110
image MIME type: image/gif
image file format: GIFF
BLOB Length: 686
-----------------------------------------

PL/SQL procedure successfully completed.


 ID  HEIGHT   WIDTH MIMETYPE        FILEFORMAT     LENGTH
--- ------- ------- --------------- ---------- ----------
  1      15      43 image/gif       GIFF             1124
  2      32     110 image/gif       GIFF              686
```

9.3.1.6 Automate the ORDImage Examples

The `setup_imgsample.sql` script runs each of the previous image scripts in the correct order to automate this process. This script is shown in Example 9–21.

Before running this script, ensure that you have these privileges:

- CREATE ANY DIRECTORY
- CREATE TABLE

Example 9–21 setup_imgsample.sql Script

```
-- setup_imgsample.sql
--

--Create the media_dir load directory:
@create_mediadir.sql

--Create the image_table table:
@create_imgtable.sql

--Import images into the image_table table:
@import_img.sql

--Show the properties of the images:
@showprop_img.sql

--Create a stored procedure to read from ordImage:
@read_image.sql

--Execute the stored procedure:
execute read_image(1);

--exit;
```

9.3.1.7 Clean Up the ORDImage Examples

The `cleanup_imgsample.sql` script removes the sample tables, directories, and procedures created by the previous image scripts from your database. This script is shown in Example 9–22.

Before running this script, ensure that you have the DROP ANY DIRECTORY privilege.

Note: Run this script as the user who ran the previous image scripts.

Example 9–22 cleanup_imgsample.sql Script

```
-- cleanup_imgsample.sql
--
-- Drop the image load directory.
DROP DIRECTORY media_dir;

-- Drop the tables created by the demo.
DROP TABLE image_table PURGE;

-- Drop the procedures.
DROP PROCEDURE read_image;
DROP PROCEDURE load_image;

exit;
```

9.3.2 Loading an Image Table from an HTTP Data Source

The `import_imghttp.sql` script imports the image data from an HTTP data source. This script inserts two rows into the `image_table` table and loads the image data from the specified HTTP data source (source type `HTTP`, URL location, and HTTP object name). This script is shown in Example 9–23.

To run this script successfully, you must modify it to point to two images located on your Web site, as described in Example 9–23.

Example 9–23 Import Image Data from an HTTP Data Source

```
-- import_imghttp.sql
--
-- Import the two HTTP images from a Web site into the database.
-- Prerequisites
--    Follow these steps before running this script:
--        1. Run create_imgdir.sql.
--        2. Run create_imgtable.sql.
--        3. Modify the HTTP URL and object name to point to two images on
--           your Web site.

-- Insert two rows with an empty BLOB.

insert into image_table values (7,ORDImage(
'http','http://your_website/images','image1.jpg'));

insert into image_table values (8,ORDImage(
'http','http://your_website/images','image2.gif'));

commit;

DECLARE
  obj ORDSYS.ORDIMAGE;
  ctx RAW(64) := NULL;
BEGIN
-- This imports the image file image1.gif from the HTTP source URL
-- (srcType=HTTP), and automatically sets the properties.

  select Image into obj from image_table where id = 7 for update;
    obj.import(ctx);
```

```
  update image_table set image = obj where id = 7;
  commit;

-- This imports the image file image2.gif from the HTTP source URL
-- (srcType=HTTP), and automatically sets the properties.

  select Image into obj from image_table where id = 8 for update;
    obj.import(ctx);

  update image_table set image = obj where id = 8;
  commit;
END;
/
```

9.3.3 Addressing Globalization Support Issues

The `globalization.sql` script demonstrates how to address issues related to globalization support. It shows how to use the process( ) method with language settings that use the comma as the decimal point. For example, when the territory is `FRANCE`, the decimal point is expected to be a comma. Thus,`",75"` is specified as the scale factor. This script is shown in Example 9–24.

Example 9–24 Address a Globalization Support Issue

```
-- globalization.sql
--
ALTER SESSION SET NLS_LANGUAGE = FRENCH;
ALTER SESSION SET NLS_TERRITORY = FRANCE;
DECLARE
myimage ORDImage;
BEGIN

SELECT image into myimage from image_table where id=1 for update;
myimage.process('scale=",75"');
UPDATE image_table SET image = myimage where id=1;
COMMIT;
END;
/
```

Run the `showprop_img.sql` script (Example 9–20) to see the properties of the scaled image.

See Also:

Oracle Multimedia Reference for more information about ensuring the correct globalization support interpretation when using the process( ) method

9.4 Video Data Examples

Video data examples using Oracle Multimedia are not available in this chapter.

See Also:

Oracle Multimedia Reference for reference information and video data examples

A

Oracle Multimedia Sample Applications

Oracle Multimedia provides several scripts and sample applications, written in C, SQL, PL/SQL, and Java. Most of them 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 Table A–1.

Table A–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
Oracle Multimedia Java API	Linux and UNIX: *<ORACLE_HOME>*/ord/im/demo/java Windows: *<ORACLE_HOME>*\ord\im\demo\java
Oracle Multimedia Java Servlet Photo Album	Linux and UNIX: *<ORACLE_HOME>*/ord/http/demo/servlet Windows: *<ORACLE_HOME>*\ord\http\demo\servlet
Oracle Multimedia JSP Photo Album	Linux and UNIX: *<ORACLE_HOME>*/ord/http/demo/jsp Windows: *<ORACLE_HOME>*\ord\http\demo\jsp

You can download additional sample applications from *Oracle Multimedia* on the Oracle Technology Network Web site.

This appendix includes these sections:

A.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

A.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 Section 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

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 Chapter 4 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

A.3 Oracle Multimedia Java Sample Applications

These Java sample applications are available after installing the Oracle Database Examples media.

Oracle Multimedia Java API Sample Application

The Oracle Multimedia Java API sample application shows how to use the audio, video, image, and media (ORDDoc) client-side Java classes to build your own Java applications. This Java sample application uses the sample schemas to demonstrate the use of the OrdAudio, OrdVideo, OrdImage, and OrdDoc Java objects. See Chapter 5 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

Oracle Multimedia Java Servlet Photo Album Sample Application

The Oracle Multimedia Java Servlet Photo Album sample application shows how to use Oracle Multimedia Servlets and JSP Java API to upload and retrieve multimedia data. See Section 3.2 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

Oracle Multimedia JavaServer Pages (JSP) Photo Album Sample Application

The Oracle Multimedia JSP Photo Album sample application shows how to use Oracle Multimedia Servlets and JSP Java API to upload and retrieve multimedia data. See Section 3.3 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

B

Managing Oracle Multimedia Installations

This appendix describes the management of Oracle Multimedia.

This appendix includes these sections:

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

B.1 Oracle Multimedia Installed Users and Privileges

The Oracle Multimedia installation procedure performs these functions:

- Creates the database users shown in Table B–1 with the privileges required by Oracle Multimedia.

Table B–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 B–2 for the Oracle Multimedia and `MDSYS` user accounts, and then locks the accounts and marks their default passwords as expired.

Table B–2 User Accounts and Default Passwords

User Account	Installation Password
ORDSYS	*ORDSYS*

Table B–2 (Cont.) User Accounts and Default Passwords

User Account	Installation Password
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 B–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

B.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
- Installation and Configuration Steps

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 Chapter 7).
- 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.

B.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

B.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 B–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.

B.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:

   ```
   % sqlplus

   SQL> CONNECT sys 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.

B.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

B.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

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.

Java servlets

Java classes that dynamically process HTTP requests and construct HTTP responses.

JavaServer Pages (JSP)

See **JSP**.

JSP

JavaServer Pages. Java text-based documents that execute as Java servlets, but which permit a more natural approach to creating static content than using servlets.

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.

ORDAudio

Object relational type for audio data characteristics.

ORDDicom

Object relational type for characteristics of DICOM content produced by medical devices. See *Oracle Multimedia DICOM Developer's Guide* for more information about this object type.

ORDDoc

Object relational type for heterogeneous data characteristics.

ORDImage

Object relational type for image data characteristics.

ORDSource

Object relational type that stores data source information for audio, heterogeneous, image, and video data characteristics.

ORDVideo

Object relational type for video data characteristics.

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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