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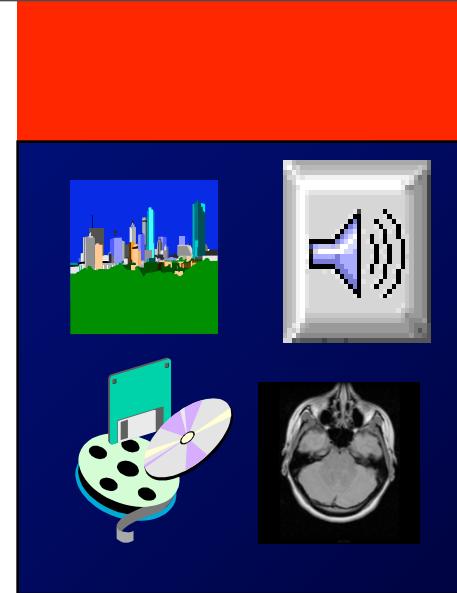
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Oracle Multimedia: Fast Performance and Deployment for Media Asset Applications

Susan Mavris
Director Oracle Multimedia Development

Agenda

- **What is Oracle Multimedia**
- Why Store Multimedia in the Database
- How to Achieve Best Performance
- Use Case - Banking
- Use Case – Asset Management
- Use Case – Medical Imaging
- Use Case – Streaming Media
- Code Example – Image Watermarking
- For More Information



What is Oracle Multimedia?

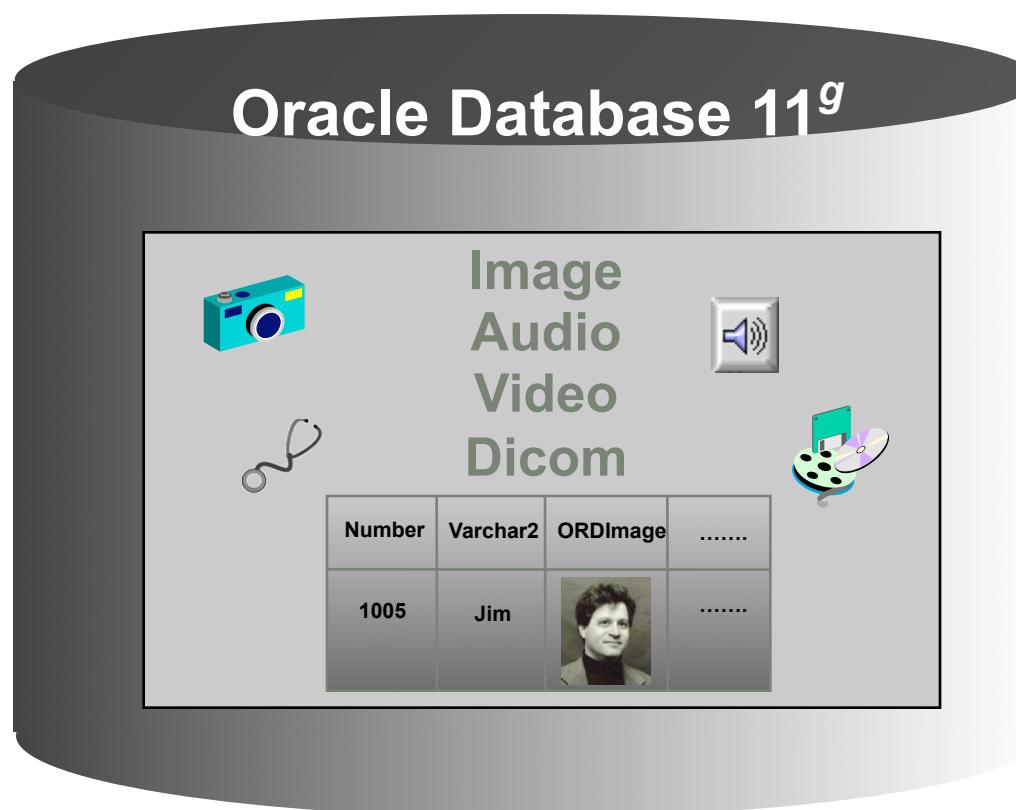
- Single integrated feature that extends the database to accommodate media
- Built on underlying database features such as
 - SecureFile LOBs
 - XML DB
 - Objects and Extensibility
- Provides services for the management of rich content including images, medical content (DICOM), audio, and video
- Recognizes most popular web media formats, offers multiple storage alternatives, and provides object, relational and standards compliant interfaces

Oracle Multimedia Capabilities (Image, Audio, Video)

- Storage and retrieval of media data
- Native format understanding, metadata extraction, methods for image processing
- Queries using:
 - Associated relational data
 - Extracted metadata
- Access through traditional and web interfaces
- Support for popular streaming technologies

Media Storage in the Database

Native datatypes for image, audio, video, dicom in the database



Oracle Multimedia Format Support (Image, Audio, Video)

Content	Formats	Storage	Indexing	Search
Image	TIFF, GIF, CALS, JPG BMP, DICOM, FPIX PBM, PGM, PPM PNM, PCX, PCT, PNG RAS, TGA, WBMP	Database, Files, URL	Format, Application Derived Metadata	By Format, App Metadata, XML
Audio	AIFF, AIFC, AU, WAV MPEG1,2&4 (including MP3), 3GP, WMA, ASF RealNetworks	Database, Files, URL	Format, Application Derived Metadata	By Format, App Metadata, XML
Video	Quicktime, AVI, 3GP, MPEG1,2&4, WMV, ASF, RealNetworks	Database, Files, URL	Format, Application Derived Metadata	By Format, App Metadata, XML

Oracle Multimedia Capabilities (Digital Imaging and Communications in Medicine)

- Native DICOM Support: Full DICOM Part 10 format support
 - Metadata extraction of all 2028 attributes and vendor-specific attributes (inside the database or in the mid-tier)
 - Validation for quality
 - Anonymization for privacy
 - Create DICOM content from image or video + metadata
 - Convert DICOM to web-friendly formats for viewing
- Support for all content: DICOM image, video, structured reports
- Enhanced search: Fast and comprehensive search based on all or application-specific subset of DICOM metadata and device vendor-specific metadata, can link in medical ontologies
- Mining and knowledge discovery: Secondary use in the future
- Open access to DICOM content

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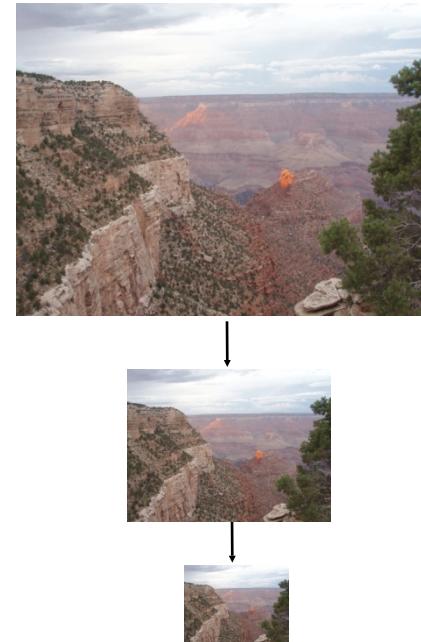
Why Store Multimedia in Oracle Database

- DBAs can manage data and media using the same management tools
- Security and auditing for both relational and multimedia data are provided by the same system
 - Database security features define roles and access
 - Virtual Private Database controls data visible to user
 - Database auditing track all access to media
 - Cryptographic signatures guarantee media has not changed
 - Encryption feature protects media data
- High availability features support multimedia data
- Database transactions guarantee media and other data are consistently stored
- The database is scalable
 - Oracle supports extremely large data sets
 - Applications can grow from very small to very large without changes

Why Store Multimedia in Oracle Database

Facilitates Multimedia “Indexing”

- Image
 - Automatic Image Thumbnail Generation
- Audio
 - Associate Audio Thumbnail (Clip)
- Video
 - Associate Video Thumbnail (Clip or Photo)
- Document
 - Associate Document Thumbnail
 - Document extract
 - Image of first page



Improves Network Performance

Multimedia Customers

Banking



The Federal Reserve Board

Web Publishing



Media



Public Sector / Defense / Education



Museums



Australian War Memorial



MUSEO di ROMA
PALAZZO BRASCHI

Life Sciences / Medical

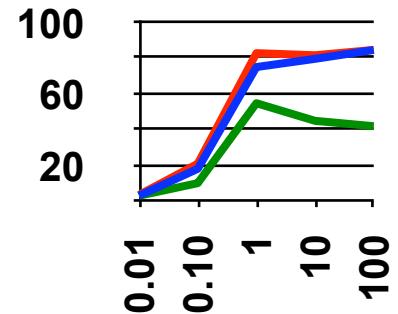


the i-engineers

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SecureFiles

Consolidated Secure Management of Data

- Many applications have both files and relational data
 - e.g. Document Management, Medical, CAD, Imaging
- **SecureFile** LOBS break the performance barrier that has kept file data out of databases
- Newly architected LOBs; much faster, and with more capabilities
 - Transparent encryption, compression, deduplication, etc.
 - Preserves security, reliability, and scalability of database
 - Superset of LOB interfaces for easy migration from BasicFile LOBs

Performance

- CAT Scan Images = 512,000 bytes per image
- READ at 800 Images / Second (428 MB/sec)
- Write at 500 Images / Second (278 MB/sec)
- Done on ONE HP /Intel Box
- **As fast as an application needs**

Create a Table for Best Performance (1 of 4)

```
create table medical_image_table
(
  id          integer not null primary key,
  JPEGImage   ordsys.ordimage,
  imageThumb  ordsys.ordimage,
  dictation   ordsys.ordaudio,
  mpegVideo   ordsys.ordvideo,
  dicom        ordsys.orddicom
)
```

Create a Table for Best Performance (2 of 4)

-- use pctfree parameter to avoid too many chained rows

pctfree 60

-- Use SecureFile LOBs for Image columns.

-- Use file system like logging.

lob(JPEGImage.source.localdata) **store as SecureFile**

(nocache filesystem_like_logging),

lob(imageThumb.source.localdata) store as SecureFile

(nocache filesystem_like_logging),

Create a Table for Best Performance (3 of 4)

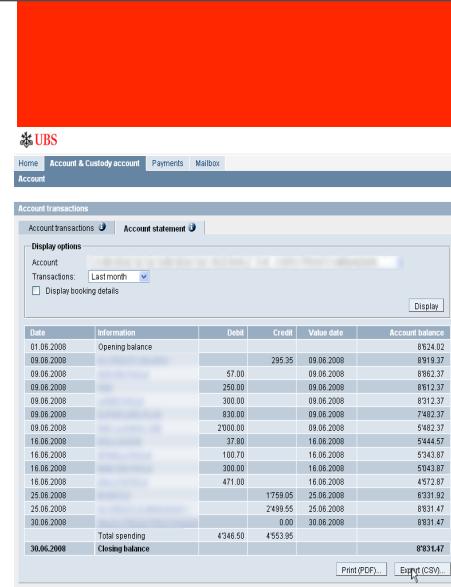
-- Use SecureFile LOBs for Audio and Video content.
-- Use file system like logging.
lob(dictation.source.localdata) store as SecureFile
(nocache filesystem_like_logging),
lob(mpegVideo.source.localdata) store as SecureFile
(nocache filesystem_like_logging),

Create a Table for Best Performance (4 of 4)

```
-- Use SecureFile LOBs for DICOM content.  
lob (dicom.source.localdata) store as securefile  
  (nocache filesystem_like_logging),  
-- disable in row storage for the extension  
lob (dicom.extension) store as securefile  
  (nocache disable storage in row),  
-- store dicom metadata attribute as securefile clob  
xmtype dicom.metadata store as securefile clob  
  (nocache disable storage in row);  
/
```

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The screenshot shows a web-based banking interface for UBS. The top navigation bar includes links for Home, Account & Custody account, Payments, and Mailbox. The 'Account' tab is selected. Below the navigation, there are buttons for 'Account transactions' and 'Account statement'. A 'Display options' section allows filtering by 'Transactions: Lastmonth' and 'Display booking details'. The main content area displays a table of transactions with columns for Date, Information, Debit, Credit, Value date, and Account balance. The table shows a sequence of deposits and withdrawals, with a total spending of 4'246.50 and a closing balance of 8'831.47. At the bottom right of the table are buttons for 'Print(PDF)...' and 'Export(CSV)...'.

Date	Information	Debit	Credit	Value date	Account balance
01.06.2008	Opening balance		295.35	09.06.2008	8'824.02
09.06.2008		57.00		09.06.2008	8'819.37
09.06.2008		250.00		09.06.2008	8'812.37
09.06.2008		300.00		09.06.2008	8'812.37
09.06.2008		830.00		09.06.2008	7'982.37
09.06.2008		2'000.00		09.06.2008	5'982.37
16.06.2008		37.80		16.06.2008	5'944.57
16.06.2008		180.70		16.06.2008	5'743.87
16.06.2008		300.00		16.06.2008	5'443.87
16.06.2008		471.00		16.06.2008	4'972.87
25.06.2008			1759.05	25.06.2008	6'391.92
25.06.2008			2499.55	25.06.2008	8'831.47
30.06.2008			0.00	30.06.2008	8'831.47
	Total spending	4'246.50	4'553.95		
30.06.2008	Closing balance				8'831.47

Use Case - Banking

- Large government bank in Brazil with over 7000 branches
- Goal was to transform the institution into a profitable enterprise, competitive with other Brazilian financial institutions
- Among other initiatives, developed an imaging application to manage images in Oracle Database
- Imaging application would allow bank customers instant web access to images of their statements

Use Case - Banking

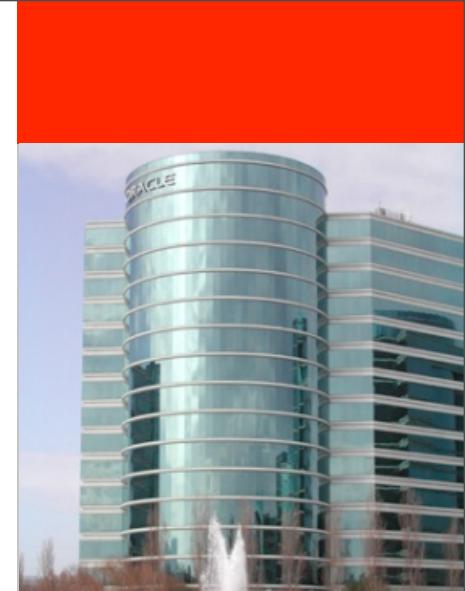
- Benefits of using Oracle:
 - Scalability and Performance
 - Image repository can grow as required
 - No need to maintain separate stores for metadata and images
 - Very high performance load using hash partitioning
 - Easy to manage
 - RMAN used to perform very large backups
 - Fast response for end user queries
 - Images retrieved and displayed by online web application
 - Security
 - Images secured with other business data

Code Example: Image Format Conversion

```
declare
  obj  ordsys.ordimage;
  gobj ordsys.ordimage;
begin
  select statementImage, gifflImage into obj, gobj from
    statementTable where AccountNo = 1 for update;
  obj.processCopy('fileFormat=giff', gobj);
  update statementTable set gifflImage = gobj
    where AccountNo = 1;
  commit;
end;
/
```

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Use Case: Asset Management

Enterprise Digital Resource Management

- Museums
 - Provide internet access to collections as well as e-business
- Corporations
 - Brand Asset Management platform for managing brand resources
- Governments
 - Digital Asset Management platform for managing digital resources such as images, video, and audio.
- Image Library
 - Image Library for complex unstructured data
- Print Media and Marketing
 - Social pages, digital asset and resource management, upselling and control, reuse of assets

Use Case: Asset Management

Piction WorkBench - Mozilla Firefox

http://silo3.piction.com/icons/qld/kau1_deewr/cc/layout.html?url=1021594685ZZO1PEJCLCKT#

PICTIONworkbench

Advanced Search

Panel Config: 1 2 Media Type Filter: All Logout

System Menu

- Authorise Request
- Metadata Attach
- Upload
- Registration Requests

Categories

- GENERAL
 - Museums
 - Videos
- LIMITED
- RESTRICTED
- UPLOAD

LightBox

Select a lightbox to view its contents.

Metadata

EDIT METADATA

AUTHOR
The Louvre

CAPTION
The Louvre

KEYWORDS
museum, Paris

The screenshot shows a grid of 12 asset thumbnails arranged in a 3x4 layout. Each thumbnail has a unique identifier and a caption below it. The first row contains: 3990170102_5a8112e550 (The Louvre, museum, Paris); 3990170562_198690af13 (Sainsbury Centre, museum, University); 3990171514_886e4981e9 (Sainsbury Centre, museum, University); and 3990171924_6fda30d3dc (Sainsbury Centre, museum, University). The second row contains: 3990172350_6e169e0568_o (National Gallery in, National Gallery in); 3990172412_3396c9a85a_o (National Gallery in, National Gallery in); 3990172510_74d962b938_o (The Tate Modern, The Tate Modern); and 3990172812_85d26cc367_o (The Tate Modern, The Tate Modern). The third row contains: 3990171514_886e4981e9 (Sainsbury Centre, museum, University); 3990172412_3396c9a85a_o (National Gallery in, National Gallery in); 3990172510_74d962b938_o (The Tate Modern, The Tate Modern); and 3990172812_85d26cc367_o (The Tate Modern, The Tate Modern).

Use Case: Asset Management

- Benefits of Using Oracle
 - Manageability
 - Multimedia data kept in synch with metadata.
 - Thumbnail image created and metadata created in one transaction
 - Security
 - Fine grained access control (individual users to individual images)
 - Features such as timeout, check in/check out, auditing, media access exclusivity are possible
 - Backup/Recovery
 - One mechanism for all data including media

Use Case: Asset Management

- Benefits of Using Oracle
 - Extensibility
 - Media can be pyramid indexed, documents can be thematically searched and gists extracted
 - Image format conversion, image copy and resize, image quality control, sharpen, watermark
 - Flexibility
 - Sets of media can be deleted, updated, and copied as easily as writing a query
 - Media data can be linked together and metadata can easily be attached. All data related to media data (or sets of media data) logically co-exists

Code Example: Image Thumbnail Generation

```
declare
  obj  ordsys.ordimage;
  tobj ordsys.ordimage;
begin
  select photo, thumb into obj, tobj from
    photoTable where id = 1 for update;
  obj.processCopy('maxScale=32 32', tobj);
  update photoTable set thumb = tobj
    where id = 1;
  commit;
end;
/
```



Code Example: Metadata Extraction (1 of 3)

```
declare
  image      ordsys.ordimage;
  metav      xmlsequencetype;
  meta_root  varchar2(40);
  xmlORD    xmltype;
  xmlIXMP   xmltype;
  xmlEXIF   xmltype;
  xmlIPTC   xmltype;
```

Code Example: Metadata Extraction (2 of 3)

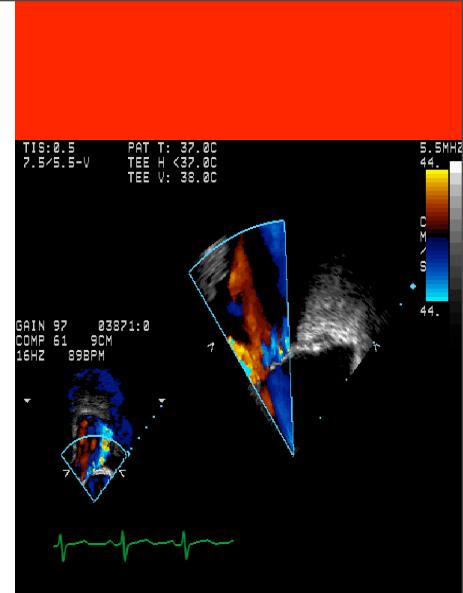
```
begin
    select photo into image from photoTable
        where id = 1;
-- extract all the metadata found in the image
metav := image.getMetadata('ALL');
```

Code Example: Metadata Extraction (3 of 3)

```
-- process 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;
end;
/
```

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Use Case – Medical Imaging Multi-disciplinary Medical Research



- Biogrid Australia: a non-profit platform for life science research teams to access and share genetic and clinical research data across organizations.
 - Links data from disparate existing databases from many institutions across several Australian states in an ethically approved, secure, controlled way
 - Intranet based solution
 - Oracle-based imaging sub-project allowed medical imaging retrieval to go from weeks or months to seconds
 - Continues to grow and expand as archives are added

Use Case – Medical Imaging

The Imaging Sub-project



- Take 7 million proprietary Magnetic Resonance Images (MRIs) on over 1000 DAT format tapes - out-of-date media, inaccessible
- Convert to Digital Imaging and Communications in Medicine (DICOM) format
- Store and index images on-line
- Extract DICOM header information
- Link into BioGrid Australia and issue record linking ID
- Retrieve de-identified images on demand
- Be economical and sustainable

Use Case – Medical Imaging

- Benefits of using Oracle Multimedia DICOM
 - Simplified IT requirements through native processing of DICOM images
 - Accelerated development and deployment
 - Preserved patient privacy by anonymizing DICOM images without losing the link between the image and patient record
 - Reduced storage requirements
 - Superior functionality at lower cost
 - Re-use implementation for future projects
 - Skilled programmers readily accessible

Code Example: DICOM Metadata Extraction

```
-- Set Data Model Repository. This procedure must be
-- called at the beginning of each database session.
execute ordsys.ord_dicom.setDataModel();
```

```
declare
  obj orddicom;
  res varchar2(1000);
begin
  select dicom into obj from medical_image_table
    where id = 'E11200S001I001.dcm' for update;
obj.setProperties();
  update medical_image_table set dicom = obj
    where id = 'E11200S001I001.dcm';
end;
/
```

Code Example: Create JPEG Thumbnail From DICOM

```
-- Set Data Model Repository.  
execute ordsys.ord_dicom.setDataModel();  
declare  
    dcmSrc ordsys.orddicom;  
    imgDst ordsys.ordimage;  
begin  
    select dicom, imageThumb into dcmSrc, imgDst  
        from medical_image_table where id = 1 for update;  
    dcmSrc.processCopy('fileFormat=jfif fixedScale=75 100',  
        imgDst);  
    update medical_image_table set imageThumb = imgDst  
        where id = source_id;  
    commit;  
end;  
/
```



Code Example: Make Anonymous DICOM Image

```
-- Set Data Model Repository.  
execute ordsys.ord_dicom.setDataModel();  
declare  
    dcmSrc  ordsys.orddicom;  
    anonDst ordsys.ordimage;  
begin  
    select dicom, anonDicom into dcmSrc, anonDst  
        from medical_image_table where id = 1 for update;  
    dcmSrc.makeAnonymous(getUID(id), anonDst);  
    update medical_image_table set anonDicom = anonDst  
        where id = 1;  
    commit;  
end;  
/
```

Patient Name

Susan Mavris



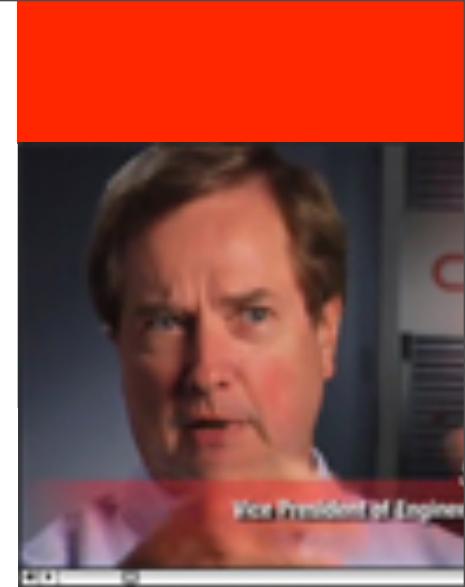
Anonymous

Code Example: SecureFiles Compression

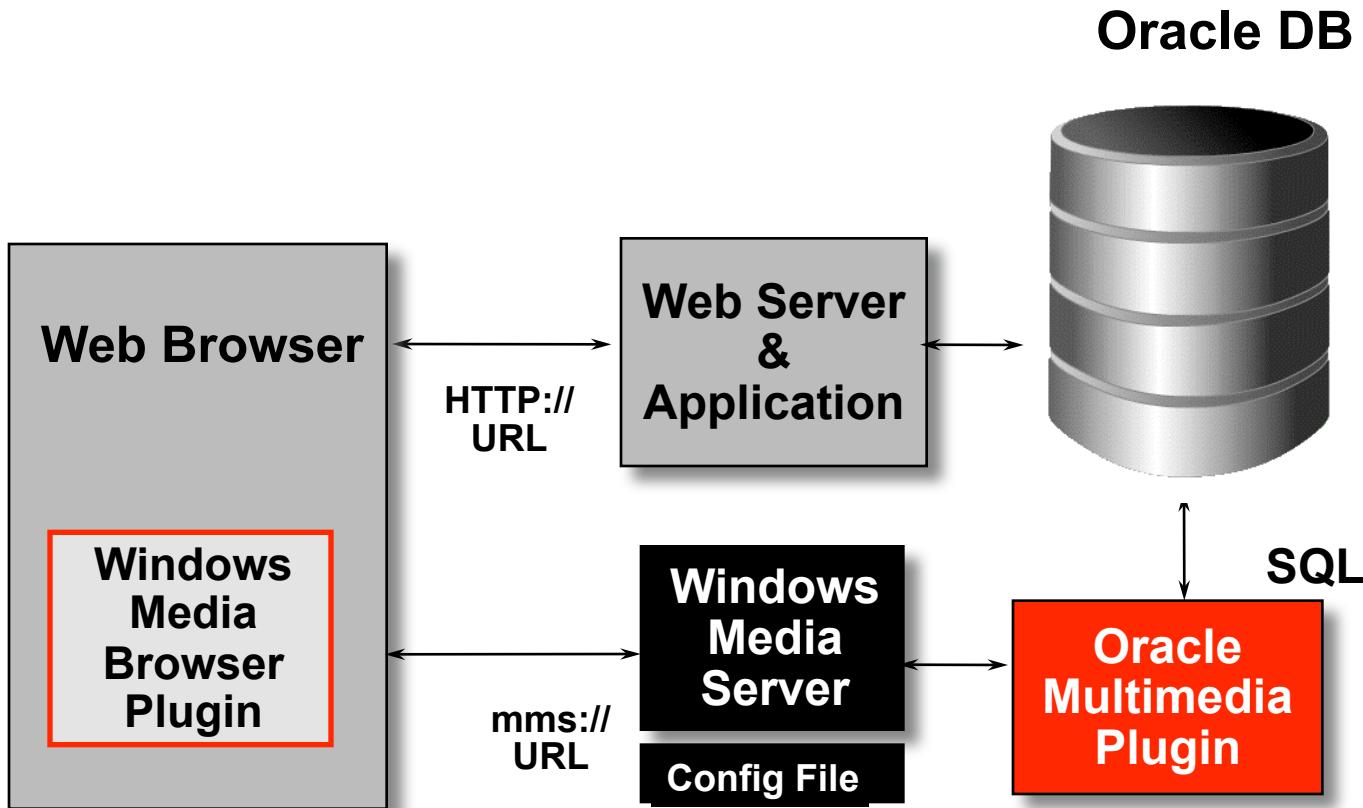
```
create table medical_image_table
(
  id          integer not null primary key,
  dicom       ordsys.orddicom,
  imageThumb ordsys.ordimage,
  ...
)
lob (dicom.source.localdata) store as securefile
  (compress high)
;
```

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Use Case: Streaming Media



Oracle Multimedia

Streaming Media Support

- Oracle Multimedia provides a plugin for Microsoft Windows Media Services
 - Allows Windows Media Servers to stream multimedia content to a client directly from Oracle Database
 - Includes Plugin Property Page accessible from Windows Media Services Administrative interface for inspection, definition, and editing of plugin mount points that map media content in the database
 - Requires Microsoft Server Enterprise Edition
- Similar plugin available for RealNetworks Helix Server

Code Example: Streaming Media (1 of 3)

-- Create table:

```
create table wmsmedia (id integer, media
  ordsys.ordvideo);
```

-- Create PL/SQL Package:

```
create or replace package get_media as
  procedure from_blob(
    idin      in integer,
    data      out blob,
    mimetype  out varchar2);
end get_media;
/
```

Code Example: Streaming Media (2 of 3)

```
-- PL/SQL Package (continue):  
create or replace package body get_media as  
procedure from_blob(  
    idin      in integer,  
    data      out blob,  
    mimetype  out varchar2)    is  
begin  
    -- get the data from the blob  
    select t.media.getContent(), t.media.getMimeType()  
        into data, mimetype from wmsmedia t  
        where id = idin;  
    end from_blob;  
end get_media;
```

Code Example: Streaming Media (3 of 3)

-- Mount point definition:

Mount Point Name: **GetMediaFromBlob**

PL/SQL Procedure Name: **get_media.from_blob**

Description: get media from blob

-- Publishing point definition:

Windows Media Server Name: **MediaServ1**

Publishing point name: **OraclePB1**

Source URL: **ord://GetMediaFromBlob**

-- Example URL to access the media:

mms://MediaServ1/OraclePB1/10

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Code Example: Apply Watermark (1 of 2)

```
declare
```

```
    source_image  ordsys.ordimage;
    watermark_image  ordsys.ordimage;
    dest_image      ordsys.ordimage;
    prop            ordsys.ord_str_list;
    logging         varchar2(2000);
```

```
begin
```

```
    select photo into source_image from imageTable where id = 1;
```

```
    select photo into watermark_image from imageTable
        where id = 200;
```

```
    select photo into dest_image from imageTable
        where id = 2 for update;
```



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Code Example: Apply Watermark (2 of 2)

```
-- specify properties
```

```
prop := ordsys.ord_str_list(  
    'position=middlecenter',  
    'width=300', 'height=50',  
    'transparency=0.3');
```

```
-- add image watermark to source image
```

```
source_image.applyWatermark(watermark_image,  
    dest_image, logging, prop);
```

```
update imageTable set photo = dest_image where id = 2;
```

```
commit;
```

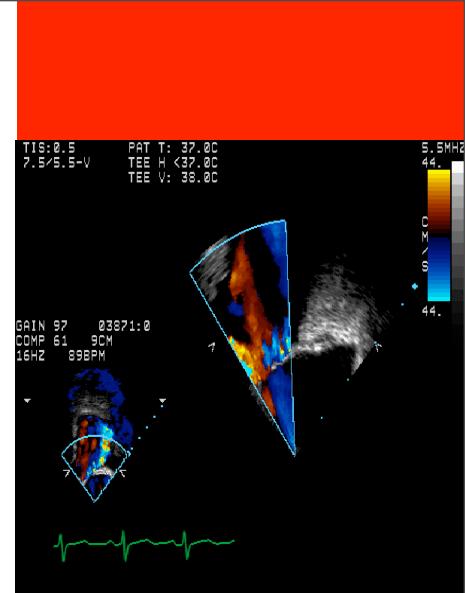
```
end/;
```

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Multimedia/DICOM at OOW 2009 - Sessions

Date/Time	Title	Location
Tuesday, Oct 13		
2:30 p.m.	Build Fast, Secure Web Applications with the PL/SQL Gateway and Oracle Multimedia	Hilton Hotel Continental Parlor 1/2/3
Wednesday, Oct. 14		
11:45 a.m.	Oracle's Multimedia DICOM API: Next-Generation Platform for Medical Imaging Solutions	Moscone South Room 270
1:00 p.m.	Unconference: Mod PL/SQL Development Tips – including Google Maps, Spatial Integration and Sending HTML Formatted Emails with Graphics	Moscone West Overlook II

Multimedia/DICOM at OOW 2009 - Sessions

- DEMOgrounds

- Enterprise Multimedia Management and Medical Imaging - *Moscone West W-021*
- Berkeley DB (DICOM demo) – *Moscone West W 035*
- Sun Microsystems (Scalable and Efficient Tiered Archive) – *Moscone South - 1101*
- LSI Systems (IBM Booth) – *Moscone South – 733*

For More Information

search.oracle.com

Oracle Multimedia



or

oracle.com/technology/products/multimedia/index.html

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