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)

<table>
<thead>
<tr>
<th>Content</th>
<th>Formats</th>
<th>Storage</th>
<th>Indexing</th>
<th>Search</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Image</strong></td>
<td>TIFF, GIF, CALS, JPG BMP, DICOM, FPIX PBM, PGM, PPM PNM, PCX, PCT, PNG RAS, TGA, WBMP</td>
<td><strong>Database, Files, URL</strong></td>
<td><strong>Format, Application Derived Metadata</strong></td>
<td><strong>By Format, App Metadata, XML</strong></td>
</tr>
<tr>
<td><strong>Audio</strong></td>
<td>AIFF, AIFC, AU, WAV MPEG1,2&amp;4 (including MP3), 3GP, WMA, ASF RealNetworks</td>
<td><strong>Database, Files, URL</strong></td>
<td><strong>Format, Application Derived Metadata</strong></td>
<td><strong>By Format, App Metadata, XML</strong></td>
</tr>
<tr>
<td><strong>Video</strong></td>
<td>Quicktime, AVI, 3GP, MPEG1,2&amp;4, WMV, ASF, RealNetworks</td>
<td><strong>Database, Files, URL</strong></td>
<td><strong>Format, Application Derived Metadata</strong></td>
<td><strong>By Format, App Metadata, XML</strong></td>
</tr>
</tbody>
</table>
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
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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 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
)
-- 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),
-- 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),
-- 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
xmltype dicom.metadata store as securefile clob
  (nocache disable storage in row);
/
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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

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

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

ORACLE
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;
/```
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

Web Browser

Windows Media Browser Plugin

HTTP:// URL

Web Server & Application

mms:// URL

Windows Media Server

Config File

Oracle Multimedia Plugin

Oracle DB

SQL
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
-- 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;
/

-- 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;
-- 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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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;
-- 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

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