


 **NZOUG Masterclass Series**

Oracle XML DB What's in it for me?

SAGE Computing Services
Customised Oracle Training Workshops
and Consulting
www.sagecomputing.com.au

Penny Cookson - Managing Director
www.sagecomputing.com.au


 **Overview**

- Storage methods – structured and unstructured, pros and cons
- The XMLType
- Storing, querying and updating XML using SQL
- XML schemas
- XML Validation
- XML Transformation
- XML DB repository
- Using ftp and http for access to XML documents
- Using webDAV for access to XML documents

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 **Overview**

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 **Why Do I Care?**


- XML is the de facto standard for data interchange
- XML is widely used for content management
- XML provides flexible data storage
- Store structured, semi-structured, unstructured data
- XQuery to become W3C recommendation
- Security and versioning
- XMLDB provides:
 - Native server support for storage and processing of XML documents
 - SQL access to XML data
- Access using standard internet protocols

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 **Why XMLDB**

- Without XML as a datatype
 - Complex Processing in the application ↔ XML as CLOB Shredded XML
- With XML as a datatype
 - Process XML like any other data type ↔ Native XMLType data type

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 **Functionality**

- Native storage of XML data using XMLType
- Built in methods provided for manipulating/accessing the data
- Support for W3C XML Schema standard
- Support for W3C XPath standard
- Support for W3C XQuery standard
- Repository stores XML and other documents using path based paradigm
- Performance optimisations including indexing

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Underlying Technology

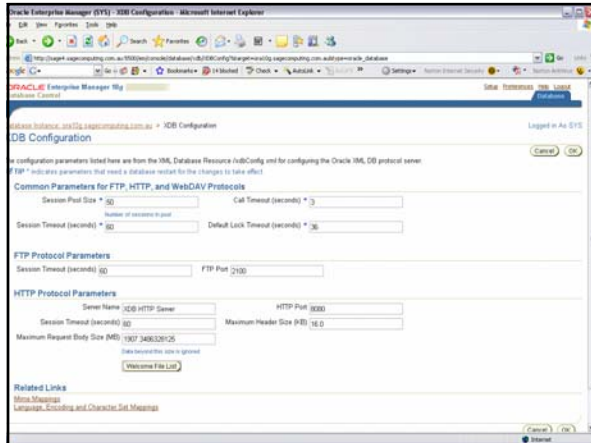
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Is it installed?

- DBCA automatically installs XMLDB functionality
- Install manually using catqm.sql and catxdbj
- XDB user owns repository
- /xdbconfig.xml stored in repository
- Configure using Enterprise Manager or manually

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The screenshot shows the 'XDB Configuration' page in Oracle Enterprise Manager. It includes sections for 'Common Parameters for FTP, HTTP, and WebDAV Protocols', 'FTP Protocol Parameters', and 'HTTP Protocol Parameters'. The 'Common Parameters' section has fields for Session Pool Size, Call Timeout, Session Timeout, and Default Lock Timeout. The 'FTP Protocol Parameters' section has fields for Session Timeout and FTP Port. The 'HTTP Protocol Parameters' section has fields for Server Name, HTTP Port, Session Timeout, and Maximum Header Size.



XMLType

- Native server data type
- Provides methods
 - extract()
 - extractValue()
 - existsNode()
 - schemaValidate()
 - transform()
- Unstructured in CLOBs
- Structured in object type tables created from schema
- Semistructured
- XMLType views for legacy data

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XMLType - Examples

```
CREATE TABLE res_docs OF XMLType;
```

```
CREATE TABLE resource_details
(code          VARCHAR2(4)
,description  VARCHAR2(50)
,daily_rate   NUMBER(6,2)
,specification XMLType);
```

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XMLType - Examples

```
INSERT INTO res_docs
VALUES(XMLType('<Equipment serialNo="1000">
<Manufacturer>ACME</Manufacturer>
<Servicedate>01-JAN-2002</Servicedate>
<Type>Video Equipment</Type>
</Equipment>'));
```

```
INSERT INTO resource_details
(code, description, daily_rate, specification)
VALUES('VCR6', 'Video recorder 6', 100,
XMLType('<Equipment serialNo="1000">
<Manufacturer>ACME</Manufacturer>
<Servicedate>01-JAN-2002</Servicedate>
<Type>Video Equipment</Type>
</Equipment>'));
```

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Storage Methods

<p>Unstructured- CLOB</p> <ul style="list-style-type: none"> ■ Entire document in a single CLOB ■ Fast storage and retrieval of entire document ■ Preserves original document ■ Store any document ■ Can be indexed using function based index or Oracle text ■ Limited intelligent processing ■ XPath operations require creation of DOM from document ■ No piecewise update ■ More space ■ Non schema based 	<p>Structured</p> <ul style="list-style-type: none"> ■ Contents decomposed into set of objects ■ Increased processing in storage and retrieval ■ Loses whitespace / data format, maintains DOM fidelity ■ Limited changes to schema ■ XQuery and XPath converted to native database queries ■ B*Tree, function based and Oracle text indexes ■ XML schema annotation determines storage type ■ Less space
--	--

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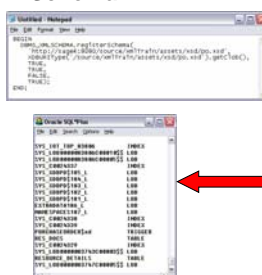
A Closer Look at Structured Storage

Register Schema → Oracle defines an object Type for each complexType

← Collections mapped to VARRAYS

← Schema annotations determine storage structures

← Creates default tables



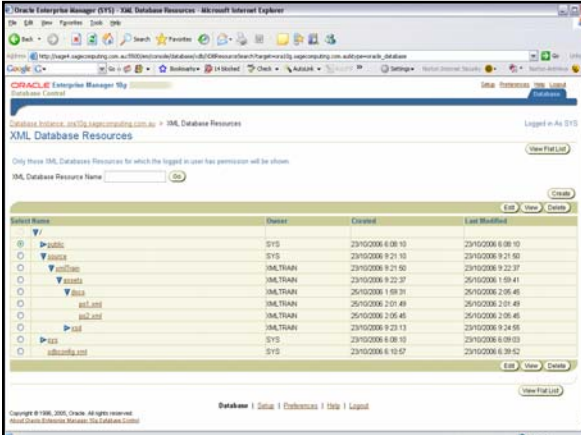
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Repository

- Hierarchical folder/file metaphor
- Stores metadata and content
- Any content , but particularly XML
- Access using
 - SQL or PL/SQL
 - standard protocols
 - Oracle Enterprise Manager

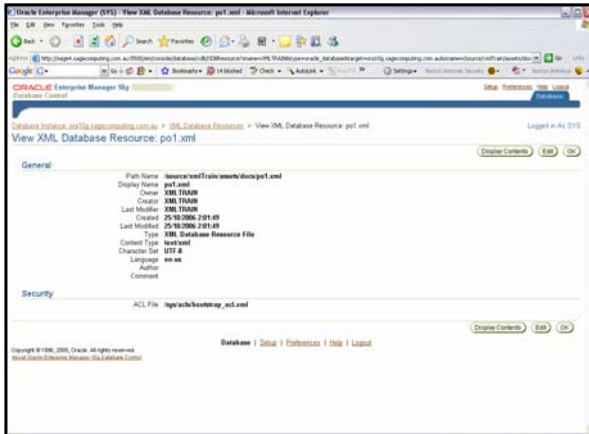
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Oracle Enterprise Manager (OEM) - XML Database Resources - Microsoft Internet Explorer

XML Database Resources

Select Name	Name	Created	Last Modified
public	SYS	23/10/2006 6:08:10	23/10/2006 6:08:10
▼ schemas			
▼ schemas	SYS	23/10/2006 9:21:10	23/10/2006 9:21:10
▼ schemas	MALTRIAN	23/10/2006 9:21:50	23/10/2006 9:22:37
▼ schemas	MALTRIAN	23/10/2006 9:22:37	23/10/2006 1:59:41
▼ schemas	MALTRIAN	23/10/2006 1:59:31	23/10/2006 2:05:45
▼ schemas	MALTRIAN	23/10/2006 2:01:49	23/10/2006 2:01:49
▼ schemas	MALTRIAN	23/10/2006 2:05:45	23/10/2006 2:05:45
▼ schemas	MALTRIAN	23/10/2006 9:23:13	23/10/2006 9:24:55
▼ schemas	SYS	23/10/2006 6:08:10	23/10/2006 6:09:03
▼ schemas	SYS	23/10/2006 6:10:57	23/10/2006 6:10:52



Oracle Enterprise Manager (OEM) - View XML Database Resource: po1.xml - Microsoft Internet Explorer

View XML Database Resource: po1.xml

General

Path Name	resources\xml\trains\assets\disc0p1.xml
Display Name	po1.xml
Owner	XML TRAINER
Creator	XML TRAINER
Last Modified	23/10/2006 2:01:49
Created	23/10/2006 2:01:49
Last Modified	23/10/2006 2:01:49
Type	XML Database Resource File
Content Type	text/xml
Character Set	UTF-8
Language	en-us
Author	
Comment	

Security

ACL File: http://schemas.xml

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XML Schema

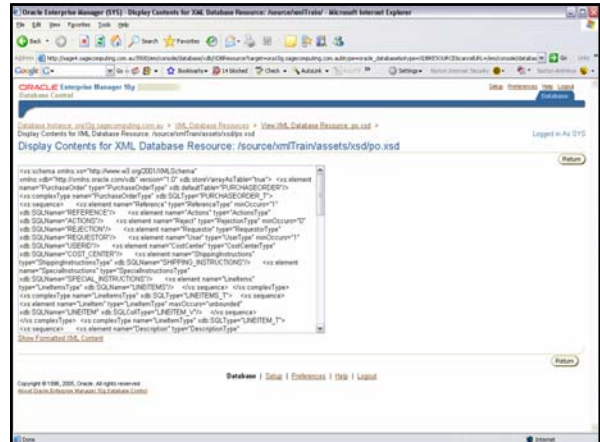
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XML Schema

- Defines validation rules
- Defines physical storage types using annotation
- Defines physical storage names using annotation
- Defined as .xsd document
- Registered using DBMS_XMLSCHEMA.registerschema

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Creating Schema Based XMLType Instances

- Pass the schema in to XMLType constructor or
- SchemaLocation defined in XML document
- Document must be well formed and conform to SQL Type definitions created by schema
- For full validation use schemaValidate() method
- Can use check constraint or trigger
- Add uniqueness and foreign key constraints

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Changing a Schema

- DBMS_XMLSCHEMA.copyEvolve
 - Copies instances to temporary tables
 - Drops old schema
 - Creates new schema
 - Registers new schema
 - Copy instances back
- Restrictions
 - Indexes, triggers, constraints lost
 - Does not support XMLType columns

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DEMO

- Create Schema
- Create document using PL/SQL
- Create document using the repository
- Validate the document

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Accessing the XML data

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Access Methods

- ◆ Query based
 - ◆ SQL
 - ◆ Java API
 - ◆ PL/SQL API
- ◆ Path based (repository)
 - ◆ SQL (RESOURCE_VIEW or PATH_VIEW)
 - ◆ PL/SQL (DBMS_XDB)
 - ◆ Protocol based

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Query Based

- ◆ Identify whether a node exists
existsNode
- ◆ Fetch a node
extract
- ◆ Fetch a value
extractValue
- ◆ Update a node
updateXML
- ◆ Transform a document
XMLtransform

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Example

```
SELECT existsNode(value(R),
  '/Equipment[Manufacturer="ACME"]') Is_There,
  extractValue(value(R),
  '/Equipment/Manufacturer') Manufacturer
FROM res_docs R;
```

```
IS_THERE MANUFACTURER
```

```
-----
1      ACME
0      SMITH AND SONS
0      SMITH AND SONS
```

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Example

```
SELECT extract(value(R),
  '/Equipment/Manufacturer') Tree
FROM res_docs R;
```

```
TREE
```

```
-----
<Manufacturer>ACME</Manufacturer>
<Manufacturer>SMITH AND SONS</Manufacturer>
<Manufacturer>SMITH AND SONS</Manufacturer>
```

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Example

```
UPDATE res_docs R
SET value(R) =
  updateXML(value(R), '/Equipment/Manufacturer/text()',
  'ACME CORPORATION')
WHERE existsNode(value(R),
  '/Equipment[Manufacturer="ACME"]') =1;
```

```
SELECT extract(value(R), '/Equipment/Manufacturer') Tree
FROM res_docs R;
```

```
TREE
```

```
-----
<Manufacturer>ACME CORPORATION</Manufacturer>
<Manufacturer>SMITH AND SONS</Manufacturer>
<Manufacturer>SMITH AND SONS</Manufacturer>
```

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Example

```
-- Create a table store the XSL stylesheet
CREATE TABLE res_xsl OF XMLType;
```

```
-- Insert the stylesheet document
INSERT INTO res_xsl
```

```
values (XMLType('<html>
<head/>
<body text="#FFFF00">
<FONT FACE="Arial">
</FONT>
.....
</body>
</html>'));
```

```
--Transform the documents
SELECT value(R), transform(value(S))
FROM res_docs(R), res_xsl;
```

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Index Options

- ◆ Use extractValue for single value
- ◆ Using extract for multiple values creates index on concatenation
- ◆ Use function based indexes
- ◆ Use bitmap indexes on existsNode
- ◆ Use ctxxpath indexes for existsNode processing

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Generate Relational data as XML

```
SELECT SYS_XMLGEN(description) DESCR,
       SYS_XMLGEN(specification) SPEC
FROM   resource_details;
```

DESCR	SPEC
<DESCRIPTION>Video recorder 6 </DESCRIPTION>	<SPECIFICATION> <Equipment serialNo="1000"> <Manufacturer>ACME CORPORATION </Manufacturer> <Servicedate>01-JAN-2002</Servicedate> <Type>Video Equipment</Type> </Equipment> </SPECIFICATION>

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Aggregate Rows

```
SELECT SYS_XMLAGG(SYS_XMLGEN(value(R)))
FROM   res_docs R;
```

```
SYS_XMLAGG(SYS_XMLGEN(VALUE(R)))
-----
<ROWSET>
<ROW>
  <Equipment serialNo="1000">
    <Manufacturer>ACME CORPORATION</Manufacturer>
    <Servicedate>01-JAN-2002</Servicedate>
    <Type>Video Equipment</Type>
  </Equipment>
</ROW>
<ROW>
  <Equipment serialNo="2000">
    <Manufacturer>SMITH AND SONS</Manufacturer>
    <Servicedate>10-DEC-2002</Servicedate>
    <Type>Video Equipment</Type>
  </Equipment>
</ROW>
```

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DEMO

Xpath queries
Updating data
Transformation

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XML Repository


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Repository Access

- ◆ PATH_VIEW
- ◆ RESOURCE_VIEW
- ◆ DBMS_XDB
- ◆ Standard protocols
 - ◆ ftp
 - ◆ http
 - ◆ WebDav
- ◆ Oracle Enterprise Manager


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DBMS_XDB

- Create a resource in the XMLDB repository
createResource
- Check whether a resource exists
existsResource
- Create a folder in the repository
createFolder
- Access documents in the repository
XDBURType.getBLOB()
XDBURType.getCLOB()
XDBURType.getXML()


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Versions

- DBMS_XDB_VERSION.MakeVersioned
- Returns resource id of first version
- DBMS_XDB_VERSION.checkOut
- DBMS_XDB_VERSION.checkIn
- DBMS_XDB_VERSION.UnCheckOut
- DBMS_XDB_VERSION.GetPredecessors
- Only for non schema based resources


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Security

- Managed in Access Contrl Lists (ACL)
- Stored in XDB.XDB\$ACL
- Resources stored in XDB\$RESOURCE
- Supports
 - Database users
 - Database roles
 - LDAP users
 - LDAP groups
- DBMS_XDB.setACL
- DBMS_XDB.GETACLDOCUMENT
- DBMS_XDB.getPrivileges

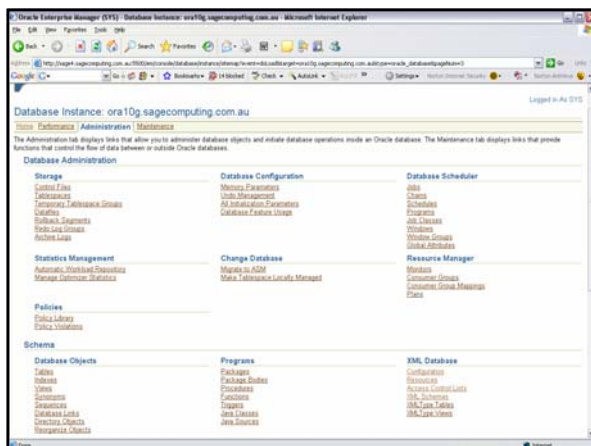
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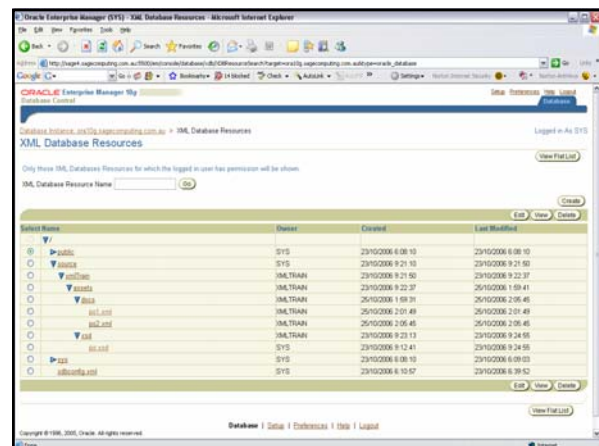
Privileges

- Atomic
 - read-properties
 - read-contents
 - update
 - read-acl
 - dav: lock
 - dav: unlock
- Aggregate
 - all
 - dav: read
 - dav: write

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Oracle Enterprise Manager (OEM) Administration page for Database Instance: ora10g.sagecomputing.com.au. The page shows various administrative tasks categorized into Storage, Database Configuration, Database Scheduler, Statistics Management, Change Database, and Resource Manager. A 'Schema' section is also visible at the bottom, listing Database Objects, Programs, and XML Databases.



Oracle Enterprise Manager (OEM) XML Database Resources page. The page displays a table of XML Database Resources with columns for Select Name, Owner, Created, and Last Modified. The table lists resources for the SYS user, including folders like 'public', 'schemas', and 'resources', and specific resources like 'res1.xml', 'res2.xml', and 'res3.xml'.

Select Name	Owner	Created	Last Modified
public	SYS	23/10/2006 6:08:10	23/10/2006 6:08:10
schemas	SYS	23/10/2006 9:21:10	23/10/2006 9:21:10
resources	XMLTRIAN	23/10/2006 9:22:37	23/10/2006 1:08:41
res1.xml	XMLTRIAN	25/10/2006 1:08:31	26/10/2006 2:05:45
res2.xml	XMLTRIAN	25/10/2006 2:01:49	26/10/2006 2:01:49
res3.xml	XMLTRIAN	25/10/2006 2:05:45	26/10/2006 2:05:45
res4.xml	XMLTRIAN	23/10/2006 9:21:13	23/10/2006 9:24:58
res5.xml	SYS	23/10/2006 9:12:41	23/10/2006 9:24:58
res6.xml	SYS	23/10/2006 6:08:10	23/10/2006 6:08:03
res7.xml	SYS	23/10/2006 6:10:57	23/10/2006 6:39:52

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