Oracle XML DB

ORACLE

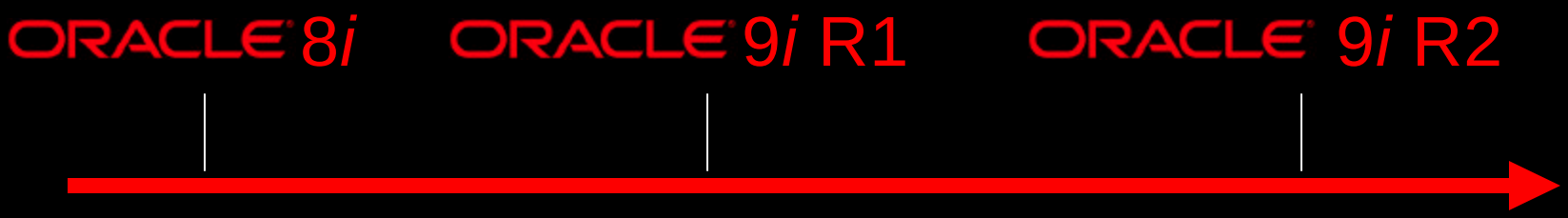
Why XML in the Database

- Enforce and leverage the XML data model
  - Loosely coupled, flexible applications
  - XML Schema, DOM
- Enable richer semantics and better management for content-oriented applications
  - Store as XML vs. Files or LOBs
  - Queryability, Integrity, RAS etc.
- Process XML close to data for high scalability and performance
  - Generation, Transformation
  - Superior memory management for large XML

Why XML in the Database (Contd.)

- Reduce maintenance costs of extra moving parts
  - Eliminate separate ‘XML-processing’ layers
- Keep applications standards-based
  - W3C, IETF, ANSI/ISO, J2EE
  - Eliminate proprietary file formats, message formats, delimited columns

Evolution of Oracle XML Support

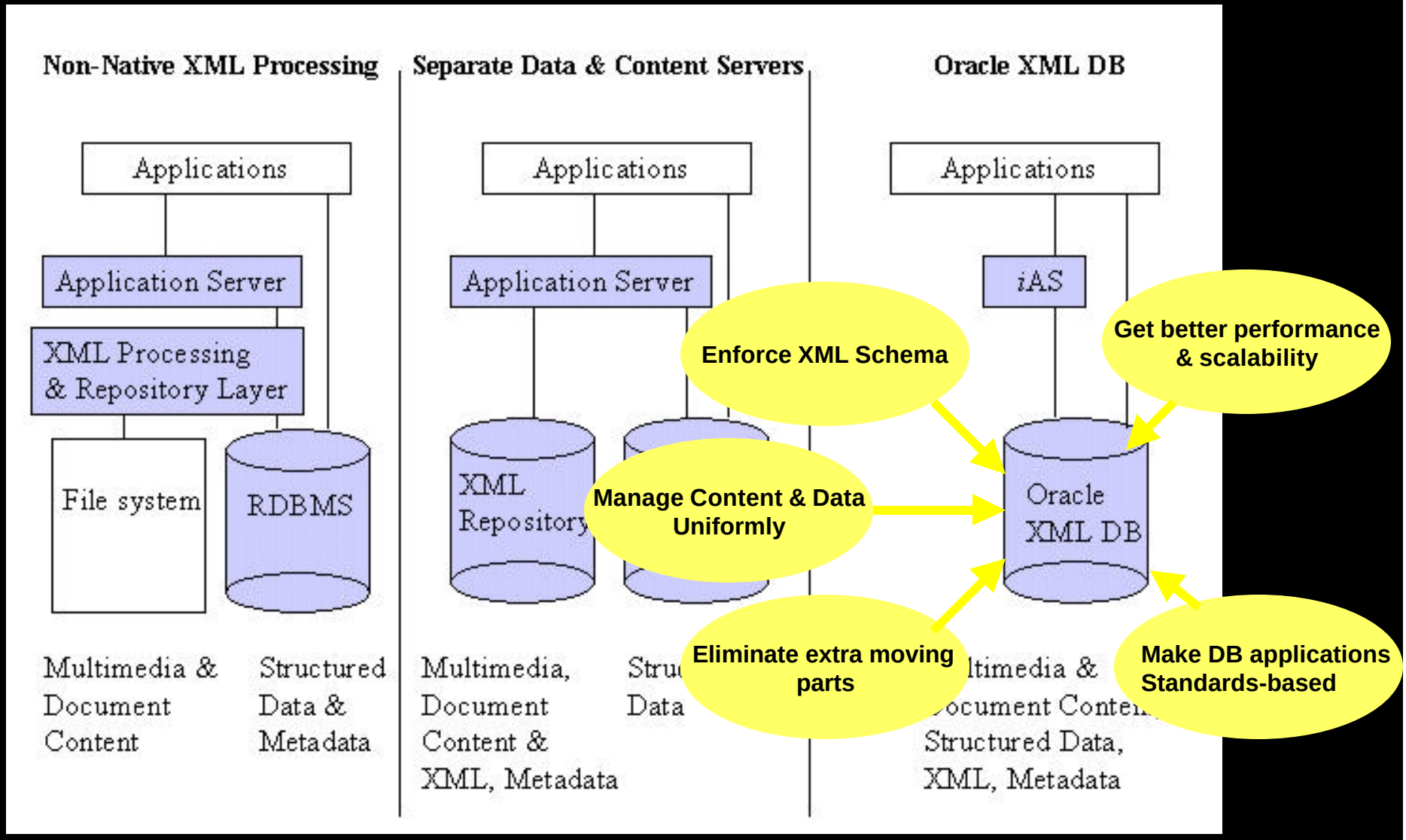


Basic XML Generation and Processing (mid-tier based) Developer Kits

DB-integrated XML Storage And Retrieval

Native XML DB

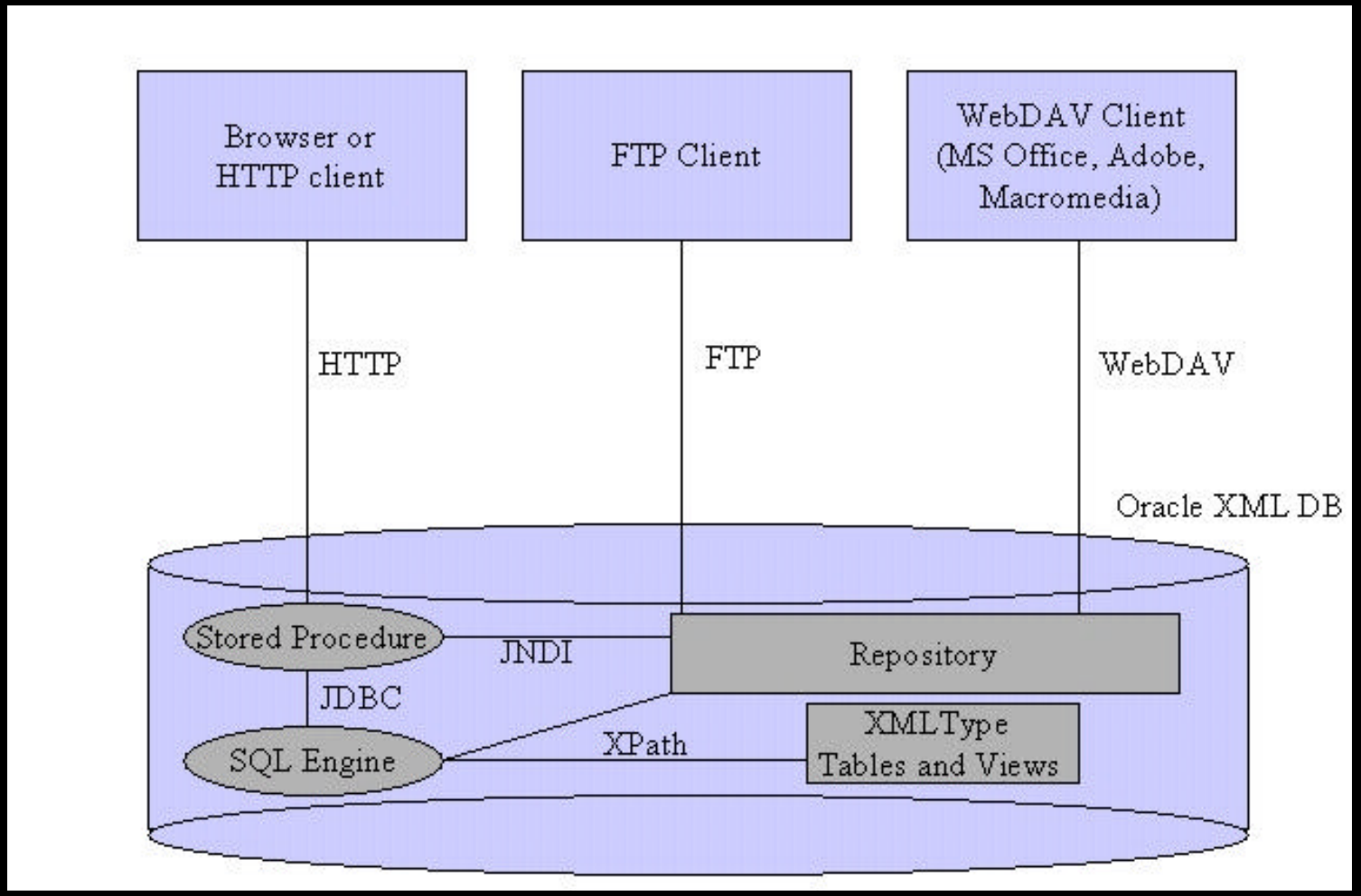
Common XML Architectures



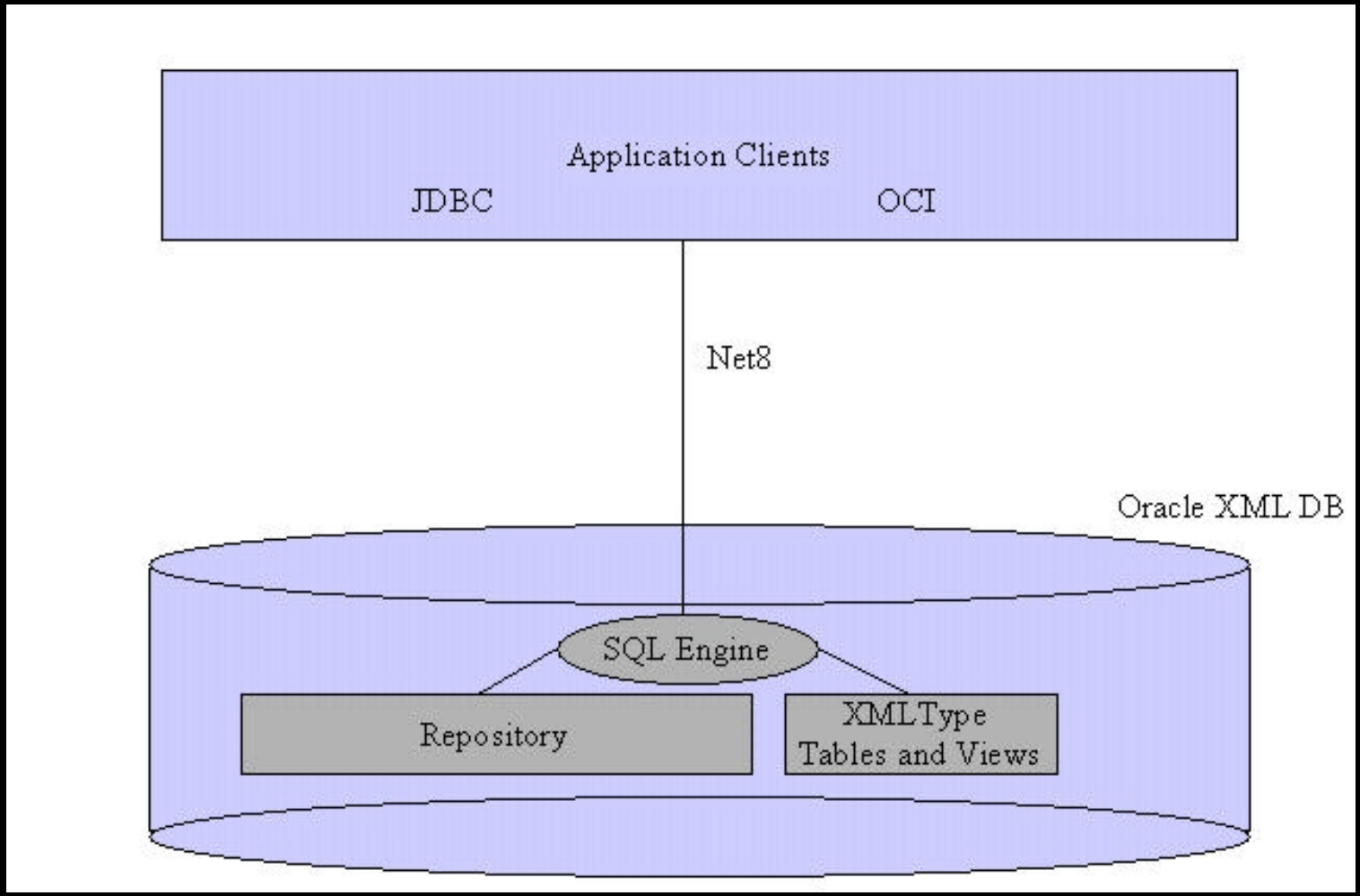
Oracle9iR2: XML DB

- Enhanced XMLType
  - XMLSchema Support
  - Object-Relational Storage Maintaining DOM fidelity
  - XML-specific memory mgmt for better scalability and performance
    - Lazily loaded virtual DOM
    - Schema caching
  - Built-in XML operators for SQL/XML interchangability
    - E.g. XMLTABLE (to cast a list of nodes returned by XPath into a table),
  - XPath Search in the server, and piecewise update of XML via XPath
  - XSL Transforms in the server
  - Enhanced XML Views for creating your own efficient representations of XML
  - Rich programming model: client side JDBC and Java Beans support
- New XML Repository
  - FTP, WebDAV, HTTP protocol servers to move XML content in and out
  - 'Foldering' and Repository view over XML Content including access control
    - Hierarchical Index for best folder-traversal performance
  - Versioning support for Repository resources
  - SQL Repository Search

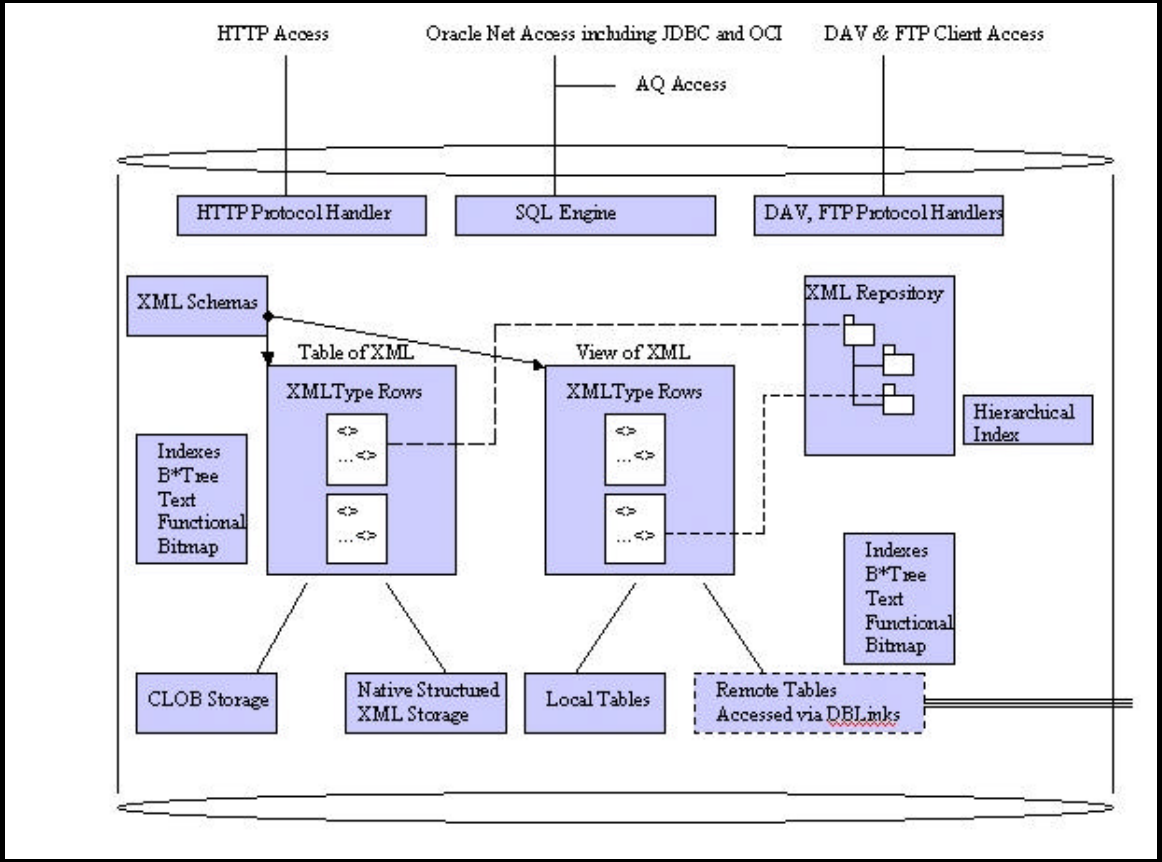
XML DB Architecture: Content



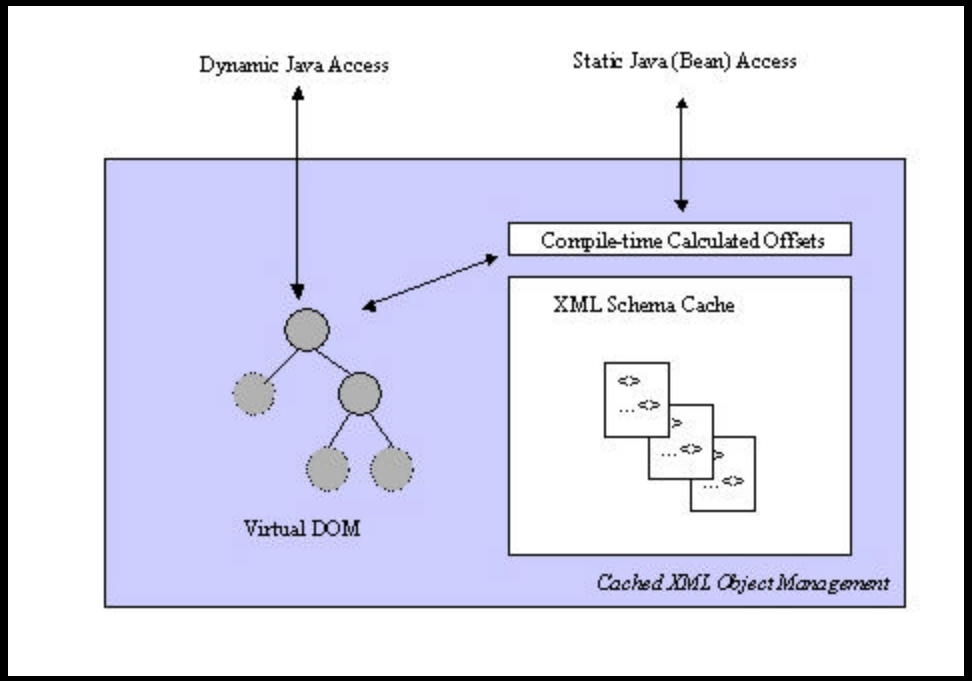
XML DB Architecture: Data



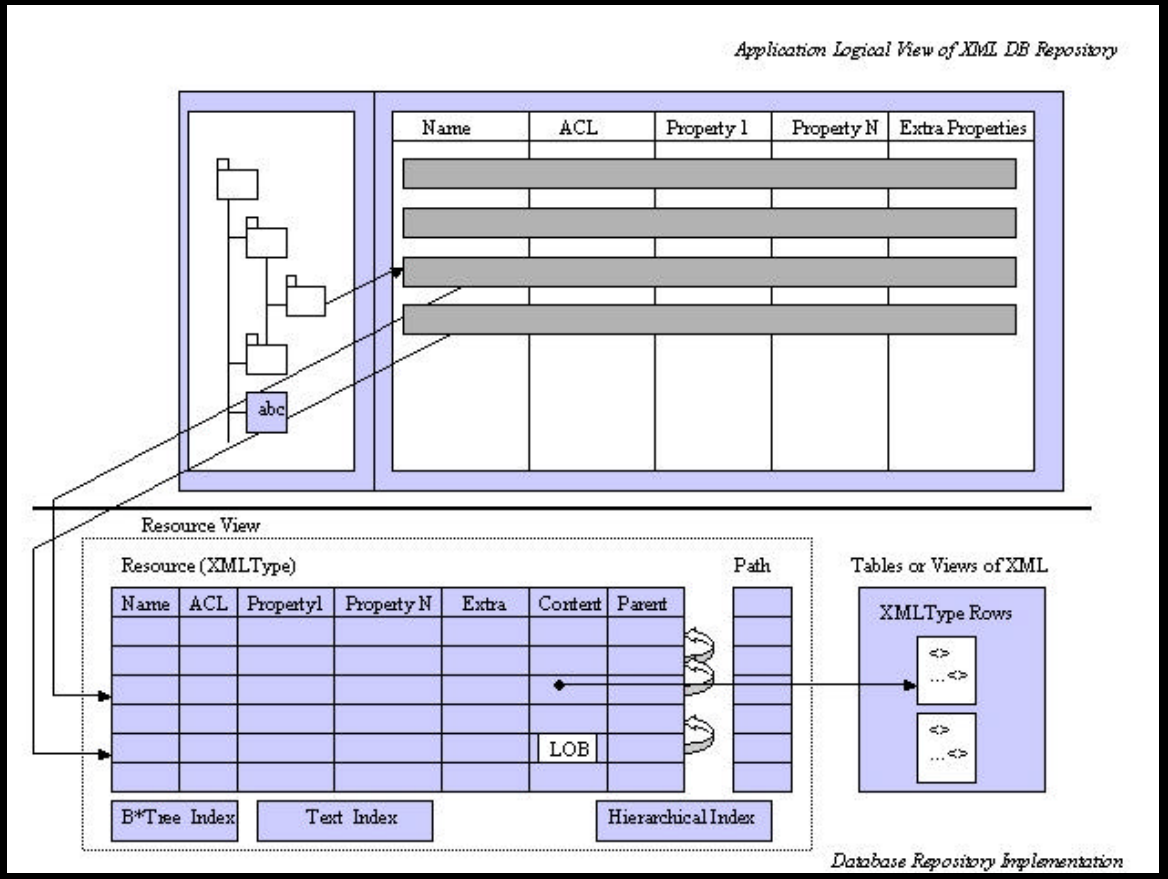
How Oracle XML DB Works: Server



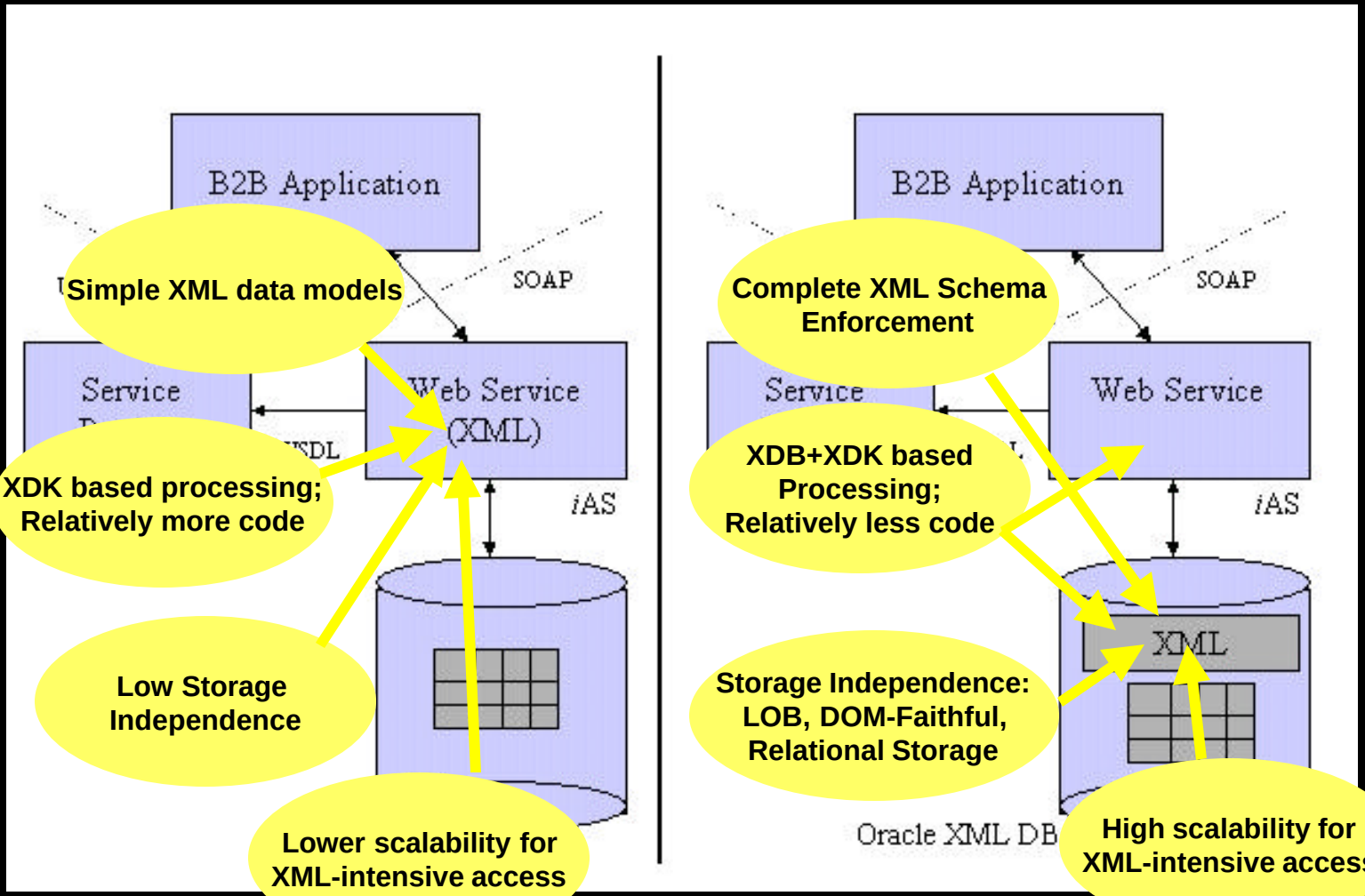
How Oracle XML DB Works: Client



The XML Repository



Building Web Services

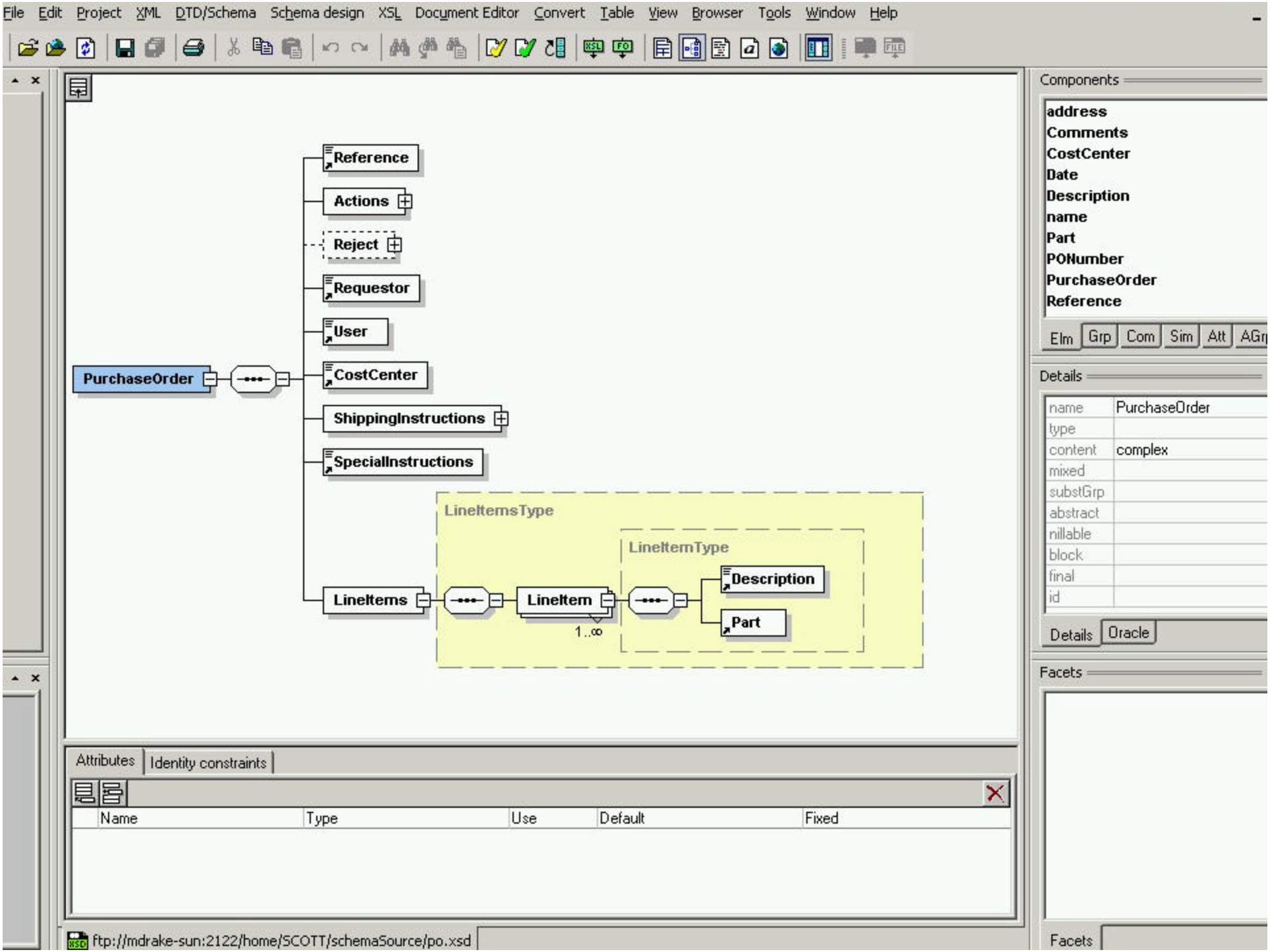


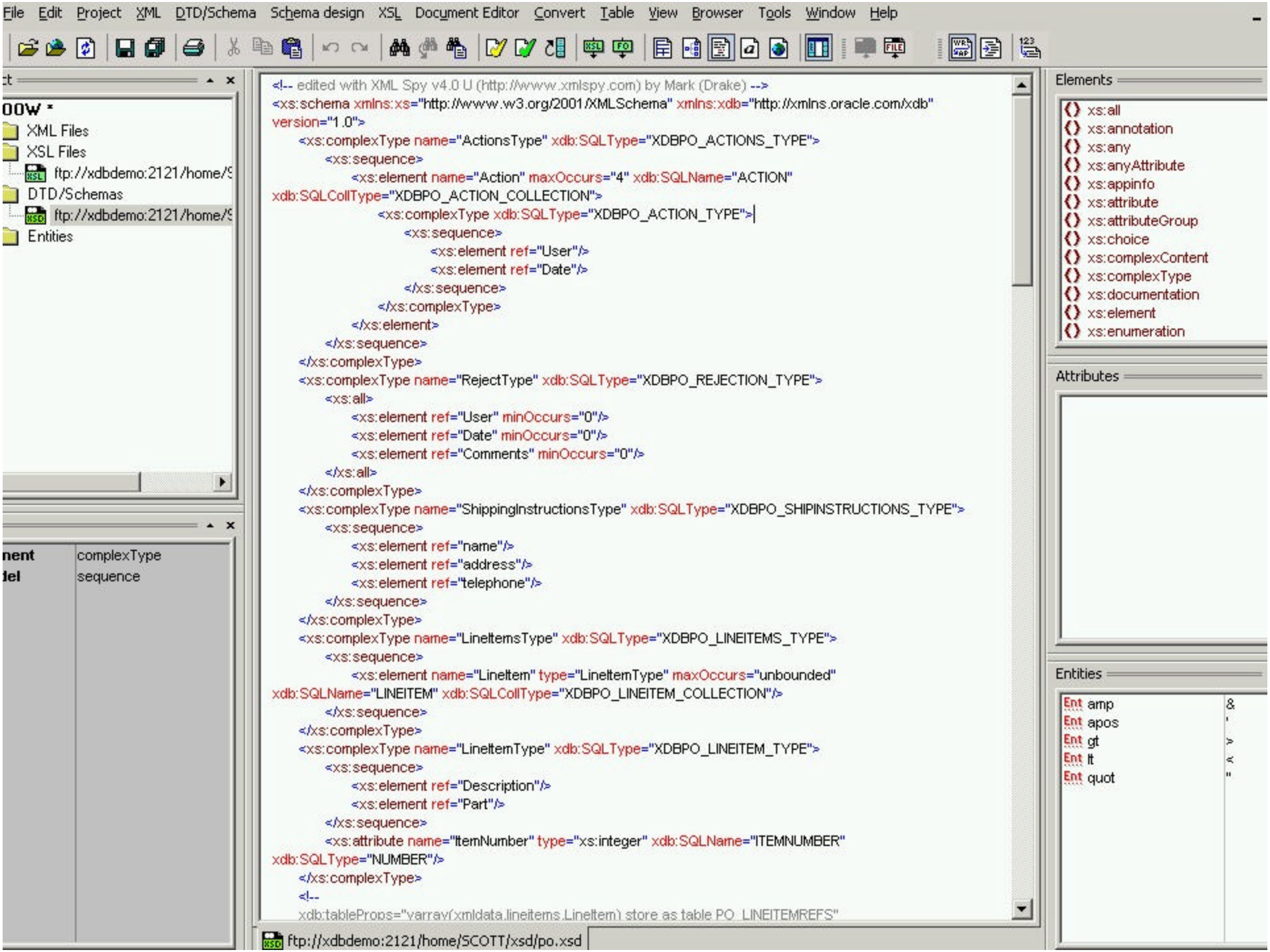
9 Benefits of Project XML DB

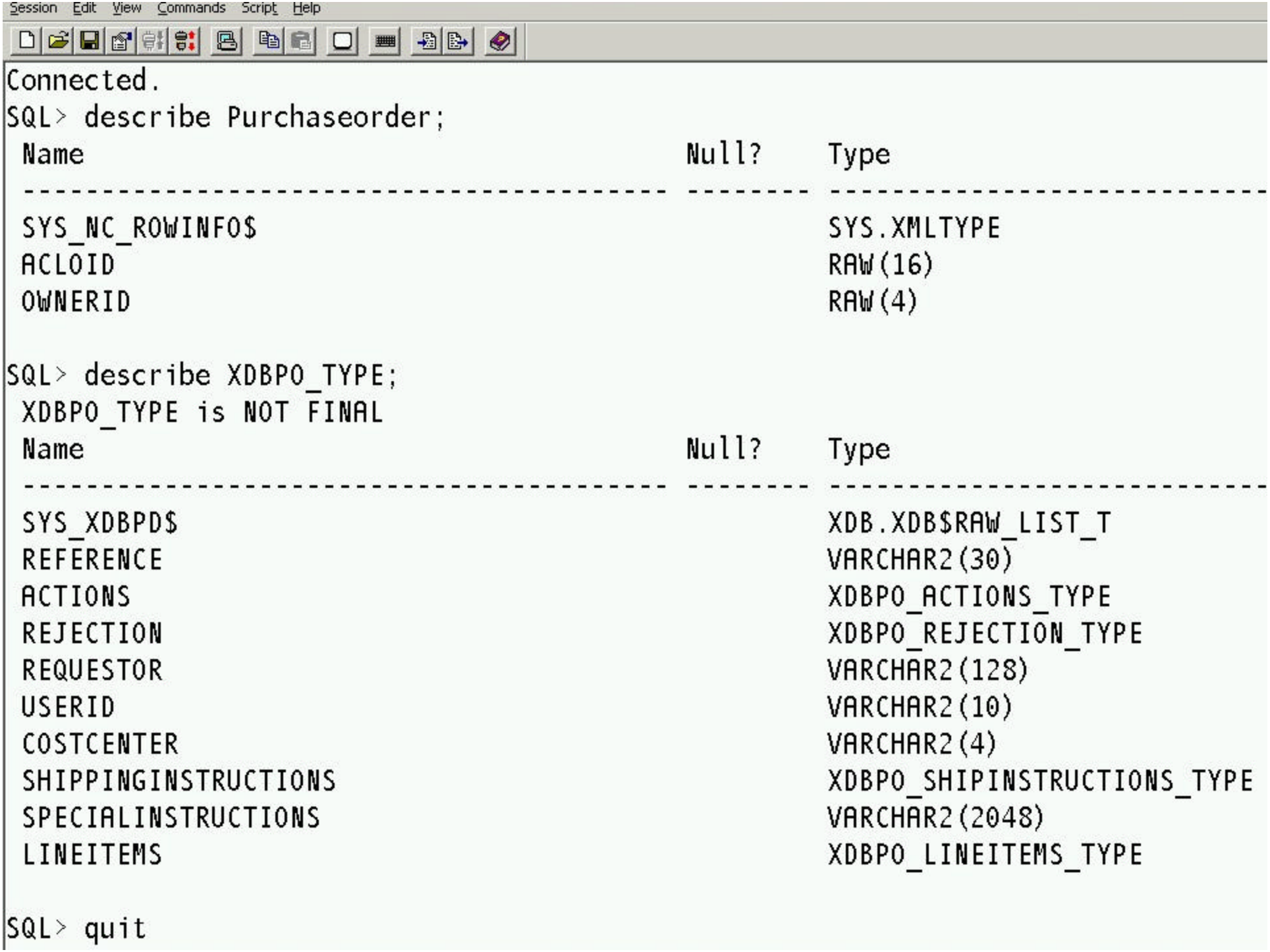
- XML SQL ‘duality’
  - SQL operations over XML data, XML operations over SQL data
- Native support for XML data model
  - XML Schema Constraints, other constraints, RI
- Storage and Structure Independence
- Strong data management over XML content vs. file storage
- Repository Functionality
- Multiple XML views over relational data
- Ease of Presentation and Interchange
  - Native XSLT, built-in generation
- All the API you want
  - DOM, JNDI, SQL, PL/SQL, Java Beans …
- XML-specific performance and scalability
  - Lazily materialized DOM, hierarchical index, direct read into buffer cache

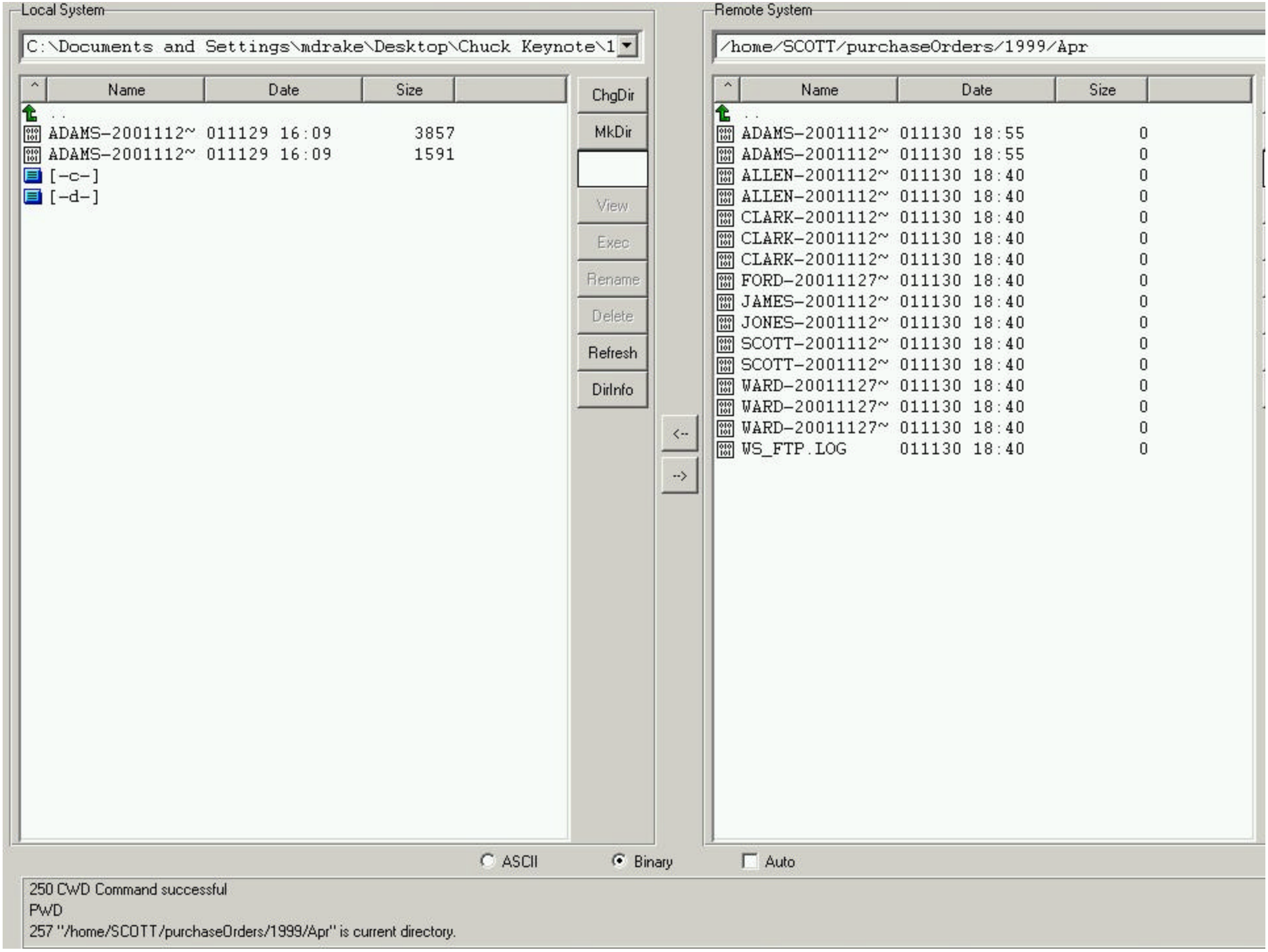
W A L K T H R O U G H

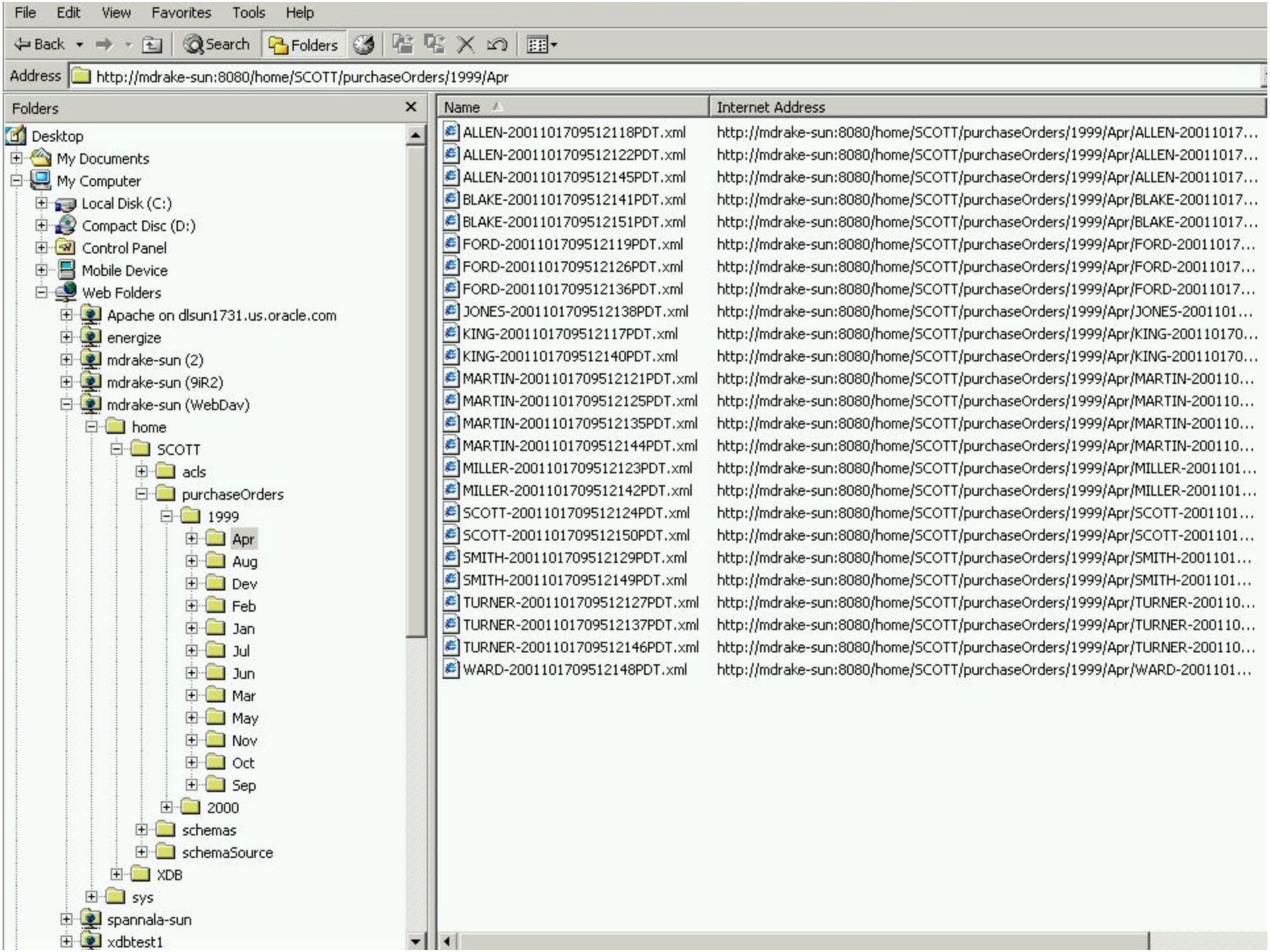
XML DB


File Edit Project XML DTD/Schema Schema design XSL Document Editor Convert Table View Browser Tools Window Help
Components
address
Comments
CostCenter
Date
Description
name
Part
PONumber
PurchaseOrder
Reference
Elm Grp Com Sim Att AGr
Details
name PurchaseOrder
type
content complex
mixed
substGrp
abstract
nillable
block
final
id
Details Oracle
Facets
Facets
Reference
Actions
Reject
Requestor
User
PurchaseOrder
CostCenter
ShippingInstructions
SpecialInstructions
LineItemsType
LineItemType
LineItems
LineItem
1..∞
Description
Part
Attributes Identity constraints
Name Type Use Default Fixed
ftp://mdrake-sun:2122/home/SCOTT/schemaSource/po.xsd

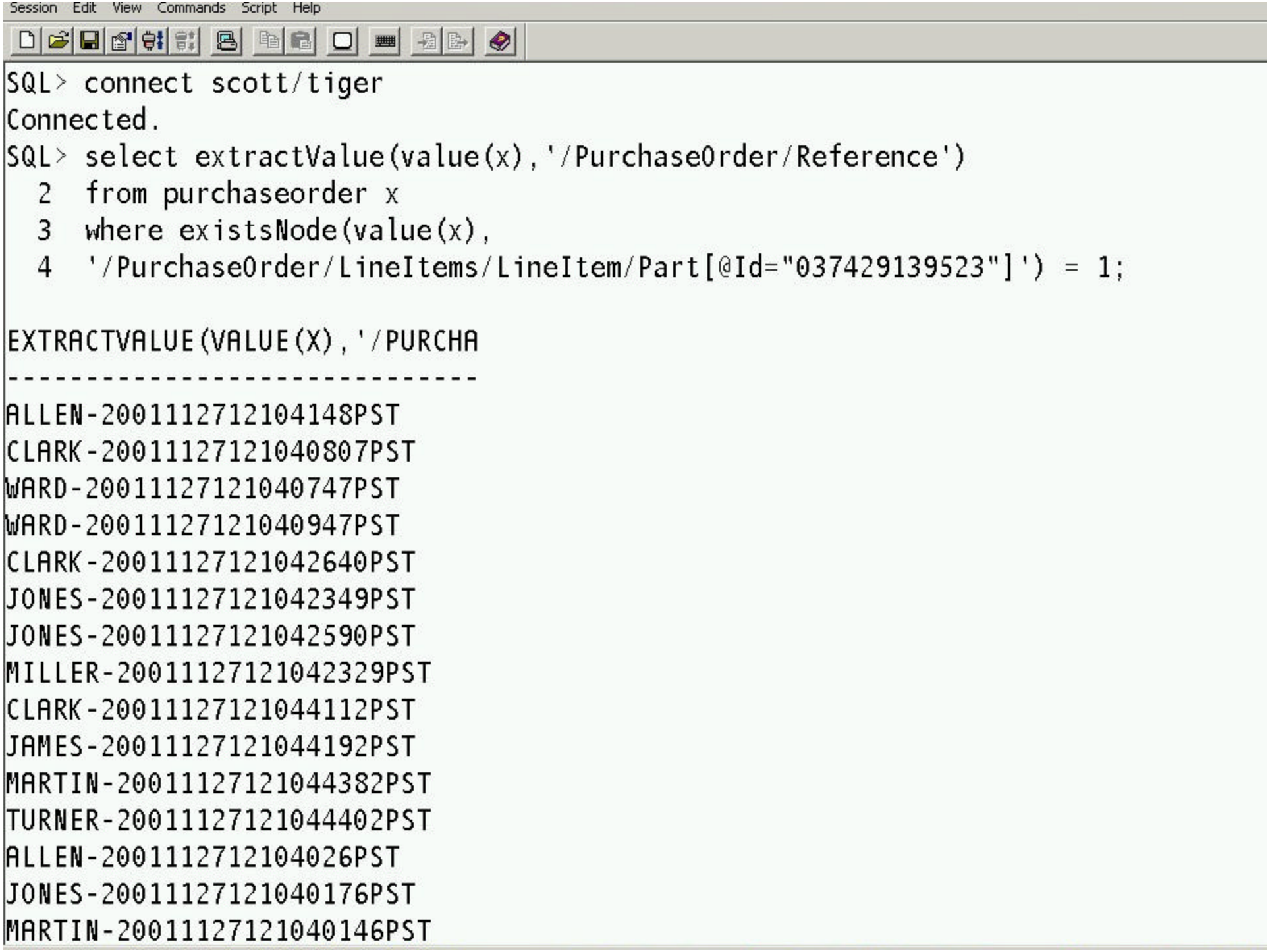

File Edit Project XML DTD/Schema Schema design XSL Document Editor Convert Table View Browser Tools Window Help
XML Files
XSL Files
DTD/Schemas
Entities
<!-- edited with XML Spy v4.0 U (http://www.xmlspy.com) by Mark (Drake) -->
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:xdb="http://xmlns.oracle.com/xdb" version="1.0">
<xs:complexType name="ActionsType" xdb:SQLType="XDBPO_ACTIONS_TYPE">
<xs:sequence>
<xs:element name="Action" maxOccurs="4" xdb:SQLName="ACTION" xdb:SQLCollType="XDBPO_ACTION_COLLECTION">
<xs:complexType xdb:SQLType="XDBPO_ACTION_TYPE">
<xs:sequence>
<xs:element ref="User"/>
<xs:element ref="Date"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
<xs:complexType name="RejectType" xdb:SQLType="XDBPO_REJECTION_TYPE">
<xs:all>
<xs:element ref="User" minOccurs="0"/>
<xs:element ref="Date" minOccurs="0"/>
<xs:element ref="Comments" minOccurs="0"/>
</xs:all>
</xs:complexType>
<xs:complexType name="ShippingInstructionsType" xdb:SQLType="XDBPO_SHIPINSTRUCTIONS_TYPE">
<xs:sequence>
<xs:element ref="name"/>
<xs:element ref="address"/>
<xs:element ref="telephone"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="LineItemsType" xdb:SQLType="XDBPO_LINEITEMS_TYPE">
<xs:sequence>
<xs:element name="LineItem" type="LineItemType" maxOccurs="unbounded" xdb:SQLName="LINEITEM" xdb:SQLCollType="XDBPO_LINEITEM_COLLECTION"/>
</xs:sequence>
</xs:complexType>
<xs:complexType name="LineItemType" xdb:SQLType="XDBPO_LINEITEM_TYPE">
<xs:sequence>
<xs:element ref="Description"/>
<xs:element ref="Part"/>
</xs:sequence>
<xs:attribute name="ItemNumber" type="xs:integer" xdb:SQLName="ITEMNUMBER" xdb:SQLType="NUMBER"/>
</xs:complexType>
<!--
xdb:tableProps="varray(xmldata.lineitems.LineItem) store as table PO_LINEITEMREFS"
ftp://xdbdemo:2121/home/SCOTT/xsd/po.xsd
Elements
xs:all
xs:annotation
xs:any
xs:anyAttribute
xs:appinfo
xs:attribute
xs:attributeGroup
xs:choice
xs:complexContent
xs:complexType
xs:documentation
xs:element
xs:enumeration
Attributes
Entities
Ent amp &
Ent apos '
Ent gt >
Ent lt <
Ent quot "

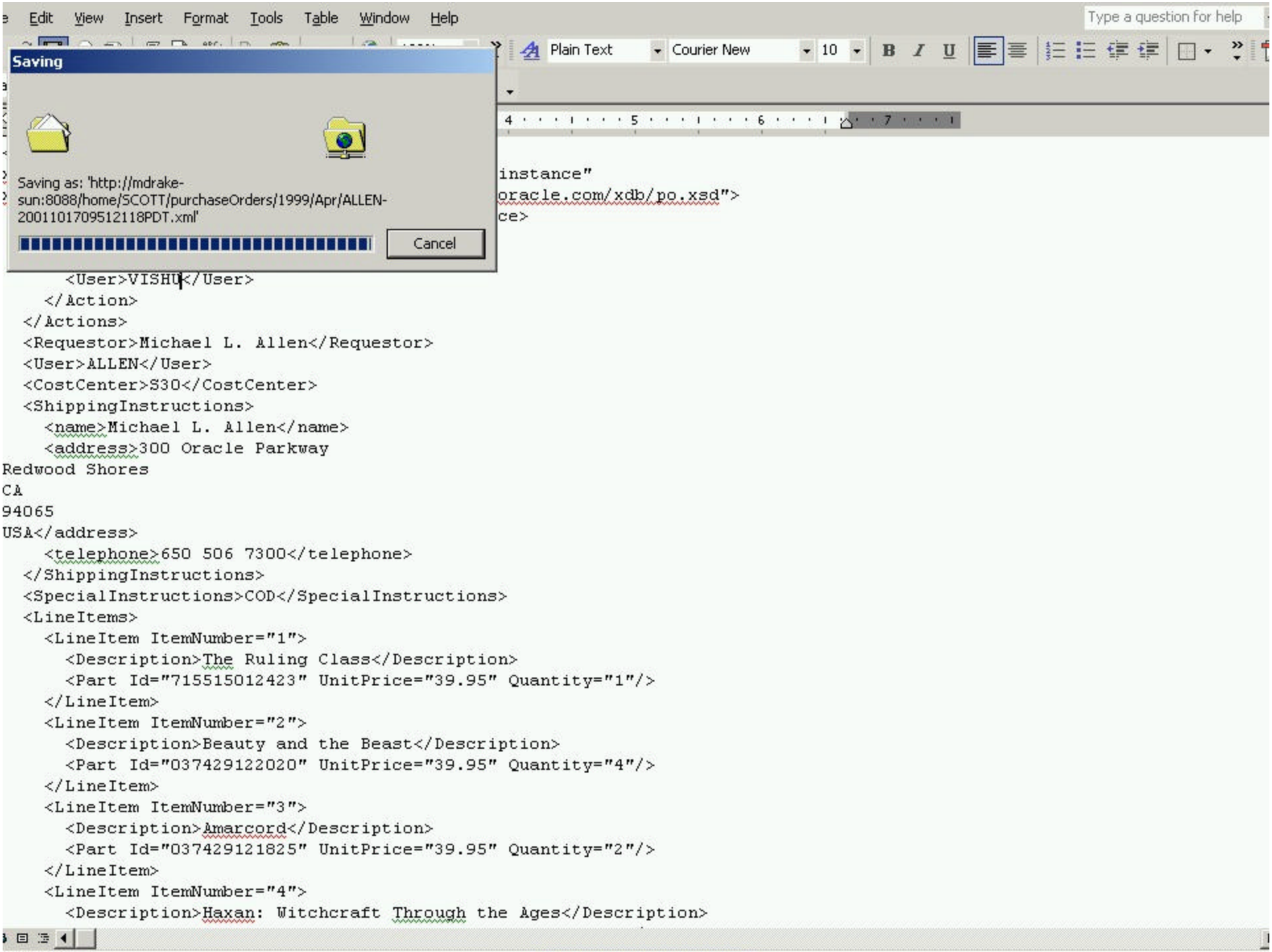

Session Edit View Commands Script Help
Connected.
SQL> describe Purchaseorder;
Name Null? Type
SYS_NC_ROWINFO$ SYS.XMLTYPE
ACLOID RAW(16)
OWNERID RAW(4)
SQL> describe XDBPO_TYPE;
XDBPO_TYPE is NOT FINAL
Name Null? Type
SYS_XDBPD$ XDB.XDB$RAW_LIST_T
REFERENCE VARCHAR2(30)
ACTIONS XDBPO_ACTIONS_TYPE
REJECTION XDBPO_REJECTION_TYPE
REQUESTOR VARCHAR2(128)
USERID VARCHAR2(10)
COSTCENTER VARCHAR2(4)
SHIPPINGINSTRUCTIONS XDBPO_SHIPINSTRUCTIONS_TYPE
SPECIALINSTRUCTIONS VARCHAR2(2048)
LINEITEMS XDBPO_LINEITEMS_TYPE
SQL> quit


Local System
C:\Documents and Settings\mdrake\Desktop\Chuck Keynote\1
Name
Date
Size
..
ADAMS-2001112~ 011129 16:09 3857
ADAMS-2001112~ 011129 16:09 1591
[-c-]
[-d-]
ChgDir
MkDir
View
Exec
Rename
Delete
Refresh
DirInfo
<--
-->
Remote System
/home/SCOTT/purchaseOrders/1999/Apr
Name
Date
Size
..
ADAMS-2001112~ 011130 18:55 0
ADAMS-2001112~ 011130 18:55 0
ALLEN-2001112~ 011130 18:40 0
ALLEN-2001112~ 011130 18:40 0
CLARK-2001112~ 011130 18:40 0
CLARK-2001112~ 011130 18:40 0
CLARK-2001112~ 011130 18:40 0
FORD-20011127~ 011130 18:40 0
JAMES-2001112~ 011130 18:40 0
JONES-2001112~ 011130 18:40 0
SCOTT-2001112~ 011130 18:40 0
SCOTT-2001112~ 011130 18:40 0
WARD-20011127~ 011130 18:40 0
WARD-20011127~ 011130 18:40 0
WARD-20011127~ 011130 18:40 0
WS_FTP.LOG 011130 18:40 0
ASCII
Binary
Auto
250 CWD Command successful
PWD
257 "/home/SCOTT/purchaseOrders/1999/Apr" is current directory.


File Edit View Favorites Tools Help
Back Search Folders
Address http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr
Folders
Desktop
My Documents
My Computer
Local Disk (C:)
Compact Disc (D:)
Control Panel
Mobile Device
Web Folders
Apache on dlsun1731.us.oracle.com
energize
mdrake-sun (2)
mdrake-sun (9iR2)
mdrake-sun (WebDav)
home
SCOTT
acls
purchaseOrders
1999
Apr
Aug
Dev
Feb
Jan
Jul
Jun
Mar
May
Nov
Oct
Sep
2000
schemas
schemaSource
XDB
sys
spannala-sun
xdbtest1
Name
Internet Address
ALLEN-20011017095121 18PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/ALLEN-20011017...
ALLEN-20011017095121 22PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/ALLEN-20011017...
ALLEN-20011017095121 45PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/ALLEN-20011017...
BLAKE-20011017095121 41PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/BLAKE-20011017...
BLAKE-20011017095121 51PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/BLAKE-20011017...
FORD-20011017095121 19PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/FORD-20011017...
FORD-20011017095121 26PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/FORD-20011017...
FORD-20011017095121 36PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/FORD-20011017...
JONES-20011017095121 38PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/JONES-2001101...
KING-20011017095121 17PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/KING-200110170...
KING-20011017095121 40PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/KING-200110170...
MARTIN-20011017095121 21PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/MARTIN-200110...
MARTIN-20011017095121 25PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/MARTIN-200110...
MARTIN-20011017095121 35PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/MARTIN-200110...
MARTIN-20011017095121 44PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/MARTIN-200110...
MILLER-20011017095121 23PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/MILLER-2001101...
MILLER-20011017095121 42PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/MILLER-2001101...
SCOTT-20011017095121 24PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/SCOTT-2001101...
SCOTT-20011017095121 50PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/SCOTT-2001101...
SMITH-20011017095121 29PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/SMITH-2001101...
SMITH-20011017095121 49PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/SMITH-2001101...
TURNER-20011017095121 27PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/TURNER-200110...
TURNER-20011017095121 37PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/TURNER-200110...
TURNER-20011017095121 46PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/TURNER-200110...
WARD-20011017095121 48PDT.xml http://mdrake-sun:8080/home/SCOTT/purchaseOrders/1999/Apr/WARD-2001101...

```
Sun Microsystems Inc.   SunOS 5.6       Generic August 1997
$ cd oow/scripts
$ sqlplus /nolog @$HOME/oow/chuck/sql/simpleQueries-1

SQL*Plus: Release 9.0.1.0.0 - Production on Fri Nov 30 19:06:34 2001

(c) Copyright 2001 Oracle Corporation.  All rights reserved.

SQL> connect scott/tiger
Connected.
SQL> select count(*) from PURCHASEORDER;

  COUNT(*)
----------
       546

SQL>
SQL> select count(*) from purchaseorder x
  2  where existsNode(value(x),'/PurchaseOrder[User="SMITH"]') = 1;

  COUNT(*)
----------
        47
```


Session Edit View Commands Script Help
SQL> connect scott/tiger
Connected.
SQL> select extractValue(value(x),'/PurchaseOrder/Reference')
2 from purchaseorder x
3 where existsNode(value(x),
4 '/PurchaseOrder/LineItems/LineItem/Part[@Id="037429139523"]') = 1;
EXTRACTVALUE(VALUE(X),'/PURCHA
ALLEN-20011127121041 48PST
CLARK-20011127121040807PST
WARD-20011127121040747PST
WARD-20011127121040947PST
CLARK-20011127121042640PST
JONES-20011127121042349PST
JONES-20011127121042590PST
MILLER-20011127121042329PST
CLARK-20011127121044112PST
JAMES-20011127121044192PST
MARTIN-20011127121044382PST
TURNER-20011127121044402PST
ALLEN-20011127121040 26PST
JONES-20011127121040176PST
MARTIN-20011127121040146PST

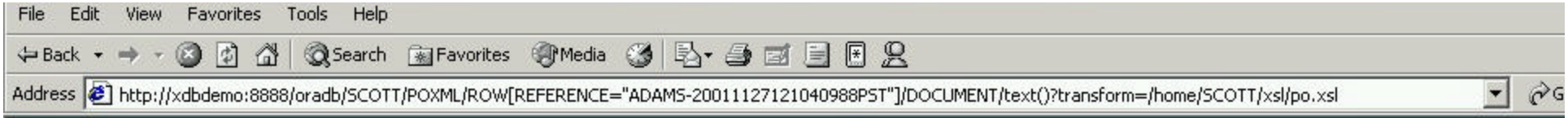

Edit View Insert Format Tools Table Window Help
Type a question for help
Plain Text
Courier New
10
Saving
Saving as: 'http://mdrake-sun:8088/home/SCOTT/purchaseOrders/1999/Apr/ALLEN-20011017095121l8PDT.xml'
Cancel
instance"
oracle.com/xdb/po.xsd">
ce>
<User>VISHU</User>
</Action>
</Actions>
<Requestor>Michael L. Allen</Requestor>
<User>ALLEN</User>
<CostCenter>S30</CostCenter>
<ShippingInstructions>
<name>Michael L. Allen</name>
<address>300 Oracle Parkway
Redwood Shores
CA
94065
USA</address>
<telephone>650 506 7300</telephone>
</ShippingInstructions>
<SpecialInstructions>COD</SpecialInstructions>
<LineItems>
<LineItem ItemNumber="1">
<Description>The Ruling Class</Description>
<Part Id="715515012423" UnitPrice="39.95" Quantity="1"/>
</LineItem>
<LineItem ItemNumber="2">
<Description>Beauty and the Beast</Description>
<Part Id="037429122020" UnitPrice="39.95" Quantity="4"/>
</LineItem>
<LineItem ItemNumber="3">
<Description>Amarcord</Description>
<Part Id="037429121825" UnitPrice="39.95" Quantity="2"/>
</LineItem>
<LineItem ItemNumber="4">
<Description>Haxan: Witchcraft Through the Ages</Description>

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://xdbdemo:8888/home/SCOTT/xsl/po.xsl

```
<?xml version="1.0" encoding="UTF-8" ?>
- <xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:xdb="http://xmlns.oracle.com/xdb"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  - <xsl:template match="/">
    - <html>
        <head />
      - <body bgcolor="#003333" text="#FFFFCC" link="#FFCC00" vlink="#66CC99" alink="#669999">
        - <FONT FACE="Arial, Helvetica, sans-serif">
            <xsl:for-each select="PurchaseOrder" />
          - <xsl:for-each select="PurchaseOrder">
            - <center>
              - <span style="font-family:Arial; font-weight:bold">
                - <FONT COLOR="#FF0000">
                    <B>Purchase Order</B>
                  </FONT>
                </span>
              </center>
              <br />
            - <center>
              - <xsl:for-each select="Reference">
                - <span style="font-family:Arial; font-weight:bold">
                    <xsl:apply-templates />
                  </span>
                </xsl:for-each>
              </center>
            </xsl:for-each>
          - <P>
            - <xsl:for-each select="PurchaseOrder">
                <br />
              </xsl:for-each>
              <P />
            - <P>
              - <xsl:for-each select="PurchaseOrder">
                  <br />
                </xsl:for-each>
              </P>
            </P>
```



Purchase Order

ADAMS-20011127121040988PST

Internal

Actions	User	Date
	SCOTT	
Requestor	Julie P. Adams	
User	ADAMS	
Cost Center	R20	

Ship To

Name	Julie P. Adams
Address	300 Oracle Parkway, Redwood Shores, CA 94065
Telephone	650 506 7300

Items:

ItemNumber	Description	PartId	Quantity	Unit Price	Total Price
1	The Ruling Class	715515012423	2	39.95	79.900000000000006
2	Diabolique	037429135020	3	29.95	89.849999999999994
3	8 1/2	037429135624	4	39.95	159.800000000000011


QUESTIONS
&
ANSWERS
ORACLE