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An Introduction to Oracle XML DB in Oracle Database 12c Release 2

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Agenda

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Introduction to XML DB

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Oracle's XML Vision

- Enable a single source of truth for XML
- Provide the best platform for managing all your XML
  - Flexibility to allow optimal processing of data-centric and content-centric XML
  - Deliver Oracle's commitment to Reliability, Security, Availability and Scalability
- Drive and implement key XML Standards
- Support SQL-centric, XML-centric and document-centric development paradigms
- Support XML in Database and Application Server

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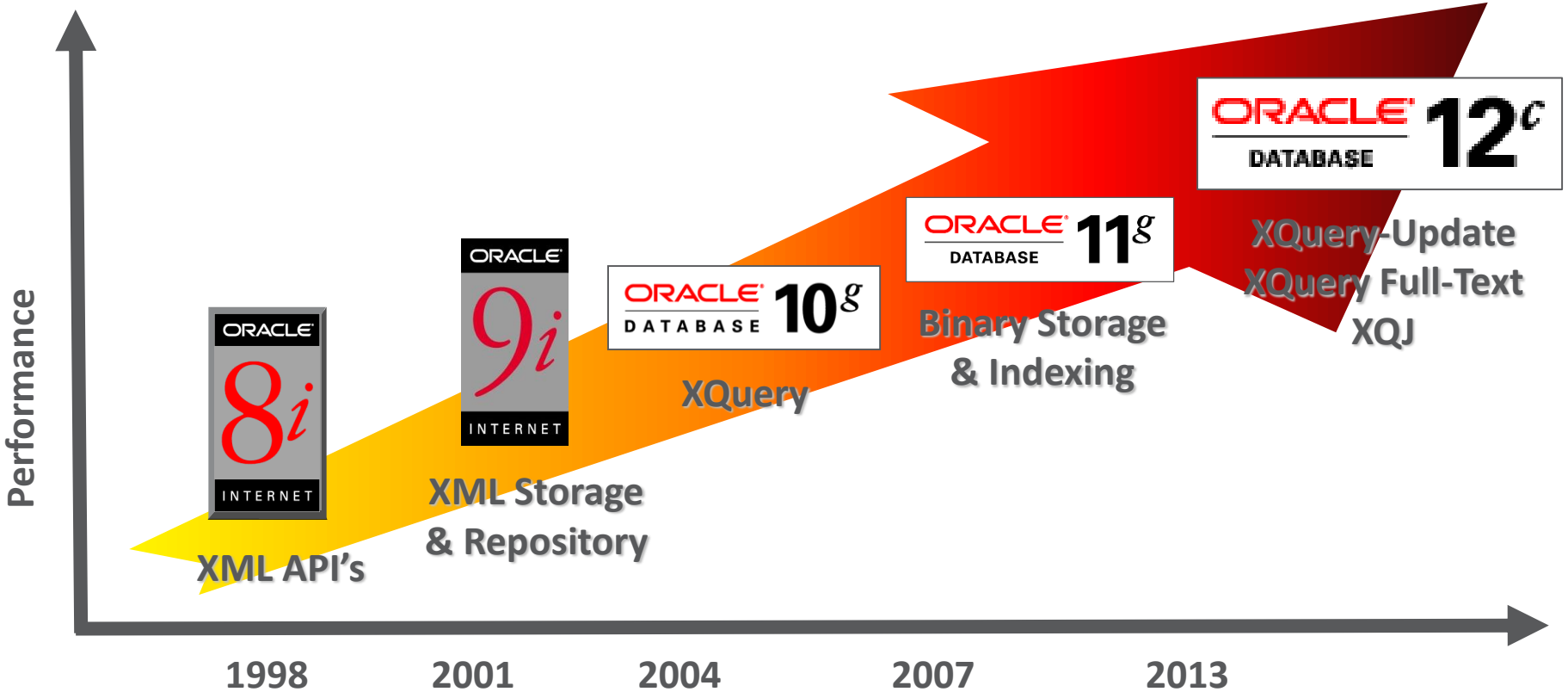
Oracle & XML : Sustained Innovation



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XMLType and XQuery

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XMLType

- Standard data type, makes database XML aware
  - Use as Table, Column, Variable, Argument or Return Value
- Abstraction for managing XML
  - Enforces XML content model and XML fidelity
  - Enables XML schema validation
  - Multiple persistence and indexing options
- Query and update operations performed using XQuery
- All application logic is independent of persistence model

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Using XMLType

```
create table INVOICES of XMLTYPE;
```

```
create table PURCHCASEORDERS (
  PO_NUMBER NUMBER(4),
  PO_DETAILS XMLTYPE
)
XMLTYPE column PO_DETAILS
XMLSCHEMA "http://schemas.example.com/PurchaseOrder.xsd"
ELEMENT “PurchaseOrder“
STORE AS OBJECT RELATIONAL;
```

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XQuery

- W3C standard for generating, querying and updating XML
  - Natural query language for XML content
  - Evolved from XPath and XSLT
  - Analogous to SQL in the relational world
- Iterative rather than Set-Based
- Basic construct is the FLWOR clause
  - for, let where, order by, return
- XQuery operations result in a sequence consisting of zero or more nodes

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XQuery FLWOR example

```
<PurchaseOrder   DateCreated=“2011-01-31”>
   …
  <LineItems>
    <LineItem ItemNumber="1">
      <Part Description="Octopus“>31398750123</Part>
      <Quantity>3.0</Quantity>
    </LineItem>
…..
    <LineItem ItemNumber="5">
      <Part Description="King Ralph">18713810168</Part>
      <Quantity>7.0</Quantity>
    </LineItem>
  </LineItems>
</PurchaseOrder>
```

for $l in $PO/PurchaseOrder/LineItems/LineItem
return $l/Part/@Description

Octopus
….

King Ralph

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XQuery fn:collection : Working with lots of XML

```
for $doc in fn:collection("oradb:/OE/PURCHASEORDER")
    return $doc
```

- Used to access a collection of documents
  - Allows an XQuery to operate on a set of XML documents
- Collection sources include
  - The contents of a folder
  - XMLType tables or columns
  - Relational Tables via a conical mapping scheme
- Protocol "oradb:" causes the components of the path should be interpreted as a Schema, Table, Column
  - Column is optional

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XQuery : Where and Order by clause

```
let $USER := “SKING”
for $doc in fn:collection(“oradb:/OE/PURCHASEORDER”)
    where $doc/PurchaseOrder[User = $USER]
    order by $doc/PurchaseOrder/Reference
    return $doc/PurchaseOrder/Reference
```

- Where clause controls which documents or nodes are processed
  - Enables the use of predicates
- Order by clause controls the ordering of nodes

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Executing XQuery in SQL*Plus

```
SQL> XQUERY
  2  let $USER := "SKING"
  3   for $doc in fn:collection("oradb:/OE/PURCHASEORDER")
  4     where $doc/PurchaseOrder[User = $USER]
  5     order by $doc/PurchaseOrder/Reference
  6     return $doc/PurchaseOrder/Reference
  7  /
```

- If XQuery statement ends with ‘;’ use empty comment (: :) to prevent semi-colon being interpreted by SQL.

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Executing XQuery using XMLTable

```
select *
 from XMLTABLE
    (
     'for $doc in fn:collection("oradb:/OE/PURCHASEORDER")
                  return $doc/PurchaseOrder/Reference'
    )
```

- Converts the sequence returned by XQuery into a relational result set
- JDBC / OCI programs
- Tools that do not yet provide native XQuery support
  - SQL*Developer, APEX SQL Workbench
- This is what the SQL*PLUS XQUERY command does under the covers

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XQuery in Database Native Web Services

```
<ENV:Envelope
        xmlns:ENV="http://schemas.xmlsoap.org/soap/envelope/"
        xmlns:ENC="http://schemas.xmlsoap.org/soap/encoding/"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <ENV:Body>
       <m:query xmlns:m="http://xmlns.oracle.com/orawsv">
                    <m:query_text type="XQUERY“> for $doc in fn:collection("oradb:/OE/PURCHASEORDER")
                     return $doc/PurchaseOrder/Reference </m:query_text>
       <m:pretty_print>true</m:pretty_print>
      </m:query>
   </ENV:Body>
</ENV:Envelope>
```

- WSDL location : http://dbserver:port/orawsv?wsdl

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JCR-225 or XQJ

```
import javax.xml.xquery.*
XQDataSource dataSource = new oracle.xml.xquery.OXQDataSource();
XQConnection connection = dataSource.getConnection();
XQExpression expression = connection.createExpression();
XQResultSequence result = expression.executeQuery ("for $doc in fn:collection(\"oradb:/OE/PURCHASEORDER\")  return
$doc/PurchaseOrder/Reference");
result.writeSequence(System.out, null);
result.close();
```

- Native XQuery API for Java
- XQJ is to XQuery what JDBC is to SQL
- Reference implementation by Oracle XMLDB

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Loading XML

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SQL Loader

```
load data
infile 'filelist.dat'
append
into table PURCHASEORDER
xmltype(XMLDATA)
(
 filename filler char(120),
 XMLDATA  lobfile(filename) terminated by eof
)
```

```
C:\purchaseOrders\ABANDA-20020405224101614PST.xml
C:\purchaseOrders\ABANDA-20020406224701221PDT.xml
…
```

- Load files from a local file system
- Filelist.dat contains a list of the files to be loaded

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BFILE Constructor

```
create or replace directory XMLDIR as ‘c:\myxmlfiles’;

insert into PURCHASEORDER values (
  XMLTYPE (
    BFILENAME(‘XMLDIR’, ‘SKING-20021009123335560PDT.xml’),
    NLS_CHARSET_ID(‘AL32UTF8’)));
```

- Directory XMLDIR references a directory in a file system local to the database server
- Must specify the character set encoding of the file being loaded.

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JDBC, OCI, PL/SQL

```
public boolean doInsert(String filename) throws SQLException,
                                                FileNotFoundException {

    String statementText = "insert into PURCHASEORDER values (:1)“;
    Connection conn = getConnection();
    OracleCallableStatement statement =
        (OracleCallableStatement) conn.prepareStatement(statementText);

    FileInputStream is = new FileInputStream(filename);
    XMLType xml = XMLType.createXML(this.getConnection(),is);
    statement.setObject(1,xml);
    boolean result = statement.execute();

    statement.close();
    conn.commit();
    return result;
 }
```

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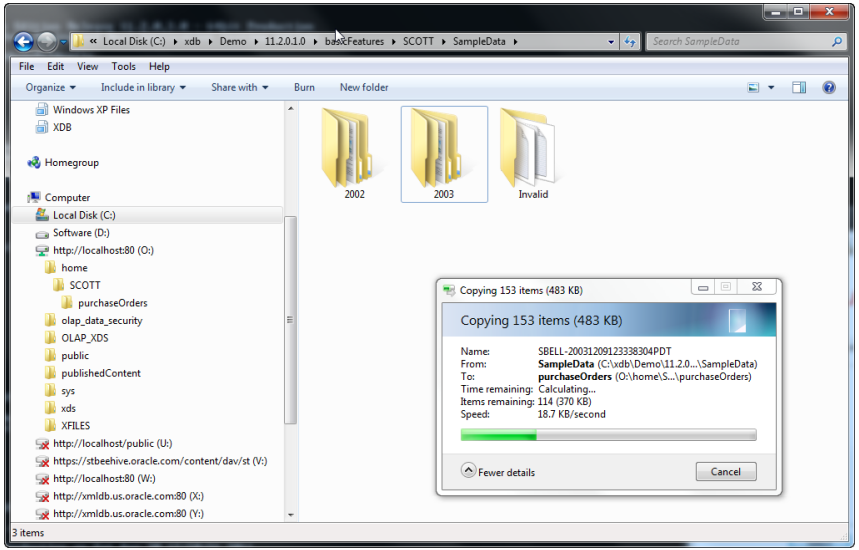
The XML DB repository and protocols



- Allows content to be loaded directly into the database using FTP, HTTP and WebDAV

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XML Generation

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Generating XML from relational data

- SQL/XML makes it easy to generate XML from relational data
  - Result set generated by SQL Query consists of one or more XML documents
- XQuery enables template-based generation of XML from relational tables
  - Use fn:collection() to generate a canonical XML representation of relational data that can be transformed using XQuery
- XMLType views enable persistent XML centric access to relational content

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Generating XML using SQL/XML

- XMLElement()
  - Generates an Element with simple or complex content
    - Simple Content derived from a scalar column or constant
    - Complex content derived from XMLType columns or generated using nested SQL/XML operators
- XMLAttributes()
  - Adds attributes to an element
- XMLAgg()
  - Generates an XML Fragment
  - Aggregation operator used to process the results of a nested sub-query

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Example : Using SQL/XML

```
select  xmlElement ( "Department",
            xmlAttributes( d.DEPTNO as “Id"),
            xmlElement("Name", d.DNAME),
            xmlElement("Employees”, (
                 select xmlAgg(
                              xmlElement("Employee",
                                   xmlForest(
                                        e.ENAME as "Name",
                                        e.HIREDATE as"StartDate”
                                    )
                               )
                          )
                    from EMP e
                   where e.DEPTNO = d.DEPTNO
            ) )
        ) as XML
  from DEPT d
```

XML

```
<Department Id="10">
 <Name>ACCOUNTING</Name>
 <Employees>
  <Employee employeeId="7782">
   <Name>CLARK</Name>
   <StartDate>1981-06-09</StartDate>
  </Employee>
  <Employee”>
   <Name>KING</Name>
   <StartDate>1981-11-17</StartDate>
  </Employee>
  <Employee>
   <Name>MILLER</Name>
   <StartDate>1982-01-23</StartDate>
  </Employee>
 </Employees>
</Department>
```

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XML and SQL Integration

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XMLExists() XQuery Predicates

```
SQL> select OBJECT_VALUE  “XML”
 2       from PURCHASEORDER
 3     where XMLEXISTS (
 4                    '$PO/PurchaseOrder[Reference=$REF]’
 5                     passing OBJECT_VALUE as "PO",
 6                     'SKING-20021009123336131PDT' as "REF“
 7                );
```

XML

```
<PurchaseOrder >
 <Reference>SKING-20021009123336131PDT</Reference>
 …
</PurchaseOrder >
```

- Use in SQL where clause to filter rows based on an XQuery expression
- Bind variables are supplied via the “Passing” clause

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XMLQuery() Fragment access

```
SQL> select XMLQUERY(
  2                  '$PO/PurchaseOrder/ShippingInstructions'
  3                  passing OBJECT_VALUE as "PO"
  4                  returning content) XML
  5     from PURCHASEORDER
  6    where XMLEXISTS(
  7                  '$PO/PurchaseOrder[Reference=$REF]'
  8                  passing OBJECT_VALUE as "PO",  'SKING-20021009123336131PDT' as "REF");
```

XML

```
<ShippingInstructions>
 <name>Steven A. King</name>
...
</ShippingInstructions>
```

- Use in SQL where clause to extract a fragment from each document in a result set.
- Bind variables are supplied via the “Passing” clause

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XMLTable() : Relational Views of XML

- The “COLUMNS” clause extends XMLTable, allowing the creation of in-line relational views of XML content
- Enables SQL operations on XML content
  - Views allow Non-XML aware tools access to XML content
- Collection hierarchy managed using chained XMLTable operations
  - Repeating elements passed down the chain as XMLType fragments

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XMLTable Columns Clause

```
SQL> select m.REFERENCE, l.LINENO, l.QUANTITY
  2     from PURCHASEORDER,
  3          XMLTable(
  4            '$PO/PurchaseOrder'     passing OBJECT_VALUE as "PO”
  5            COLUMNS
  6              REFERENCE                    VARCHAR2(32) PATH 'Reference',‘,
  7              LINEITEM_FRAGMENT            XMLTYPE PATH 'LineItems/LineItem’
  8         ) m,
  9         XMLTable(
 10            '$LI/LineItem'              passing m.LINEITEM_FRAGMENT as "LI”
 11           COLUMNS
 12             LINENO                      NUMBER(4) PATH '@ItemNumber‘,
 13             UPC                         NUMBER(14) PATH 'Part/text()‘,
 14             QUANTITY                    NUMBER(5) PATH 'Quantity‘
 15         )
 16 where l.UPC =  '24543000457’;
```

RERERENCE	LINENO	QUANTITY
AKHOO-20100418162507692PDT	2	2
PVARGAS-20101114171322653PST	1	7
JTAYLOR-20100518182653281PDT	5	4

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XQuery-Update support

Standards-compliant update of XML content

- http://www.w3.org/TR/xquery-update-10/
- Declaratively modify and transform XML content
  - Replace, Delete, Insert, Rename
- Database supports the copy / modify form of XQuery-Update
- Operations are re-written into partial-updates where possible
- XQuery update support is also enabled starting with patchset 11.2.0.3.0

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XQuery-Update support

```
update TABLE
    set XML_COLUMN =  xmlQUERY(
                                'copy $NEWXML := $XML modify (
                                  let $TARGET := $NEWXML/rootElement/targetElement
                                   return replace node $TARGET with $NEWCONTENT
                                )
                                return $NEWXML'
                                passing XML_COLUMN as "XML",  V_NEW_CONTENT as " NEWCONTENT "
                                returning content
                            )
where …
```

- Combine an XMLQuery operator containing an XQuery-Update expression with a SQL Update statement
  - The XQuery-Update supplies the new value for the XMLType

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XQuery-Update support

```
copy $NEWPO := $PO modify (
                        let $ROOT := $NEWPO/PurchaseOrder
                        let $SHIPINST := $ROOT/ShippingInstructions
                        return (
                            replace value of node $ROOT/User with $NEWUSER,
                            replace node $ROOT/Requestor with element Requestor {$NEWNAME},
                            delete node $SHIPINST/address,
                            insert node element street {$STREET} as last into $SHIPINST,
                            insert node element city {$CITY} as last into $SHIPINST,
                            insert node element zipcode {$ZIPCODE} as last into $SHIPINST
                        )
                    )
                    return $NEWPO
```

- Select target nodes using For or Let clauses
- Specify modifications in the return clause

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XQuery-Update usage

- Updating XML stored in the Oracle Database
- XML Data Masking
  - Use an XMLType view based on XQuery-Update to remove or mask content from an XML document
- Updating xml is supported using Oracle specific operators in older releases of the database
  - UpdateXML(), DeleteXML(), insertChildXML() etc
  - Legacy Oracle specific operators are deprecated in Oracle Database 12c

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XQuery-FullText support

Standards compliant Full-Text search of XML content

- XQFT http://www.w3.org/TR/xpath-full-text-10/
- Declarative full text search in XML content
  - contains text, stemming, windowing
  - Logical full text operators : ftor, ftand, ftMildNot
- The XQuery contains() operator is limited to ‘string within string’ searches
- Available starting with Oracle Database 12.1.0.1.0

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XQuery-FullText support

```
select PURCHASEORDER_XML
  from PURCHASEORDERS
where XMLExists(
          '$P/PurchaseOrder/ShippingInstructions/Address/street[. contains text {$PHRASE}]‘
          passing PURCHASEORDER_XML as "P“, 'sport' as "PHRASE“
);
```

- Use with XMLExists() operator to perform Full-Text filtering
- Use with XMLQuery() and XMLTable() to perform Full Text based fragement extraction
- Support for Document, Fragment, Element and Attribute level operations
- Document and Fragment level operations target all descendant nodes

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XQuery-FullText support

Common operations

```
$PO/PurchaseOrder/ShippingInstructions/Address/street[. contains text {$WORD} using stemming]
```

- Use Stemming to search for different forms a word

```
'$PO/PurchaseOrder/ShippingInstructions/Address[. contains text {$WORD1} ftand {$WORD2}
```

- Use FT logical operators to search for multiple words

```
$P/PurchaseOrder/ShippingInstructions/Address[. contains text {$WORD1} ftand {$WORD2} window 6 words]
```

- Use Windowing to specify the distance between words

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XQuery-FullText Indexing

- XQuery-FullText operations are optimized by XML aware Full-Text (Context) index
- Based on existing Oracle Text (Context) Technology
- Proven Full-Text search capabilities
- Fully Namespace Aware
- Use XQuery Full-Text rather than SQL's contains() operator when working with XML content
- The oracle xpath extension ora:contains() is depricated starting with Oracle Database 12c

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XQuery-FullText Index Creation

```
BEGIN
  CTX_DDL.CREATE_SECTION_GROUP('XQFT','PATH_SECTION_GROUP');
  CTX_DDL.SET_SEC_GRP_ATTR('XQFT','XML_ENABLE','T');
  CTX_DDL.create_preference('STORAGE_PREFS', 'BASIC_STORAGE');
  CTX_DDL.set_attribute( 'STORAGE_PREFS',
             'D_TABLE_CLAUSE', 'LOB(DOC) STORE AS SECUREFILE (COMPRESS MEDIUM CACHE)‘ );
  CTX_DDL.set_attribute( 'STORAGE_PREFS',
              'I_TABLE_CLAUSE', 'LOB(TOKEN_INFO) STORE AS SECUREFILE (NOCOMPRESS CACHE)');
END;
/

CREATE INDEX PURCHASEORDER_XQFT_IDX
   ON PURCHASEORDER(OBJECT_VALUE)
     INDEXTYPE IS CTXSYS.CONTEXT
     PARAMETERS(
       'storage STORAGE_PREFS|
       section group XQFT’
     )
/
```

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Other SQL/XML Operators

- XMLCast()
  - Used with XMLQuery() operator
  - Converts XML scalars into SQL scalars
- XMLTransfom()
  - XSL based transformation
- XMLNamespaces()
  - Namespace management
- SchemaValidate()
  - XMLType method for validating document against an XML Schema

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XML Storage and Indexing

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Binary Persistence

```
SQL> create table PURCHASEORDER of XMLTYPE
  2> XMLTYPE store as SECUREFILE BINARY XML;
```

- Stores post-parse representation of XML on disc
  - Reduced storage requirements
  - Tags are tokenized, content stored in native representation
- Optimized for streaming, indexing and fragment extraction.
- Single representation used on disc, in-memory and on-wire
  - No parsing / serialization overhead once XML is ingested
- Partial update
- Schema-less and XML Schema aware versions

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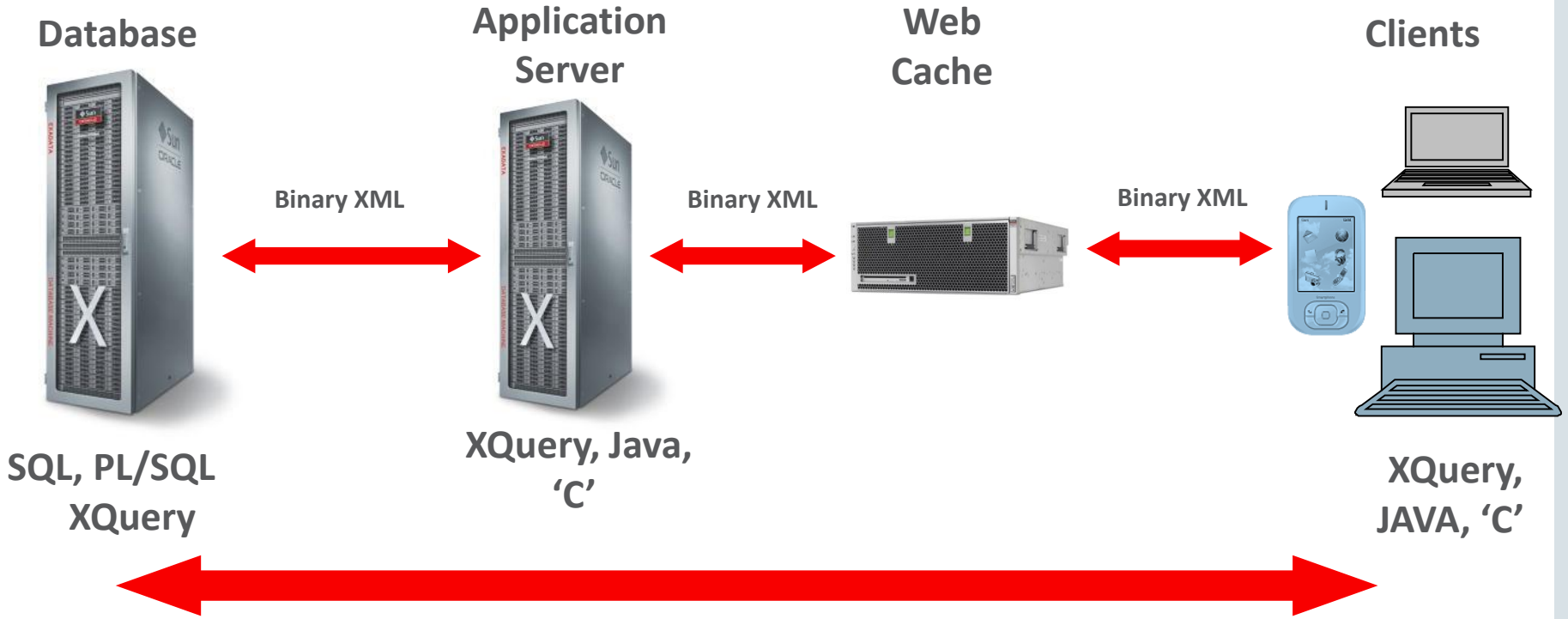
Oracle Binary XML



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Client Side Encoding

```
XMLType xml = new XMLType(connection,is);
xml.setPicklePreference(XMLType.XMLTYPE_PICKLE_AS_BINXML);
xml.setMetadataConn(connection);
statement.setObject(1,xml);
boolean result = statement.execute();
```

- Enable client side encoding by executing the methods setPicklePreference() and setMetadataConn() on the XMLType object before performing the Insert
  - Specificy XMLType.XMLTYPE_PICKLE_AS_BINXML when invoking setPicklePreference() to force client side encoding.
- Client side encoding is only supported with XMLType.
  - Currently it is not available when using the JDBC 4.0 SQLXML class

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Client Side Encoding

- Allows the overhead of parsing and encoding the XML to be moved from the database to the client
  - Reduction in overall Network Traffic
  - Reduction in Database CPU usage
  - Increase in Client CPU usage (no free lunch)
- Most effective when many similar documents will be inserted using a single database connection
- Recommended when constructing XMLType from InputStream.
- Avoid when constructing XMLType directly from XMLDocument

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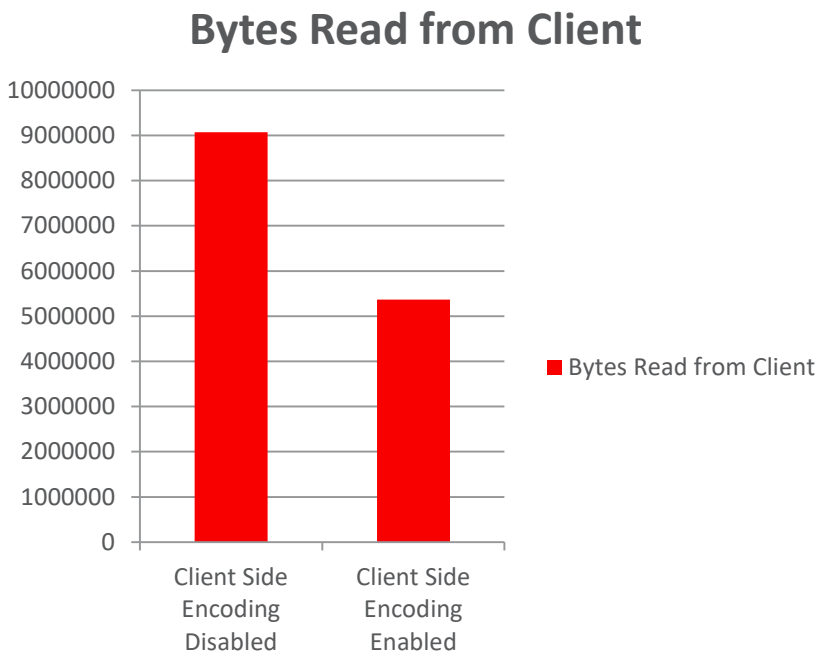
Client Side Encoding : Bytes sent to Server



- 50% reduction in bytes sent to server
- Complete Works of Shakespeare
- 36 Files, 9,067,913bytes
- High content to Tag ratio

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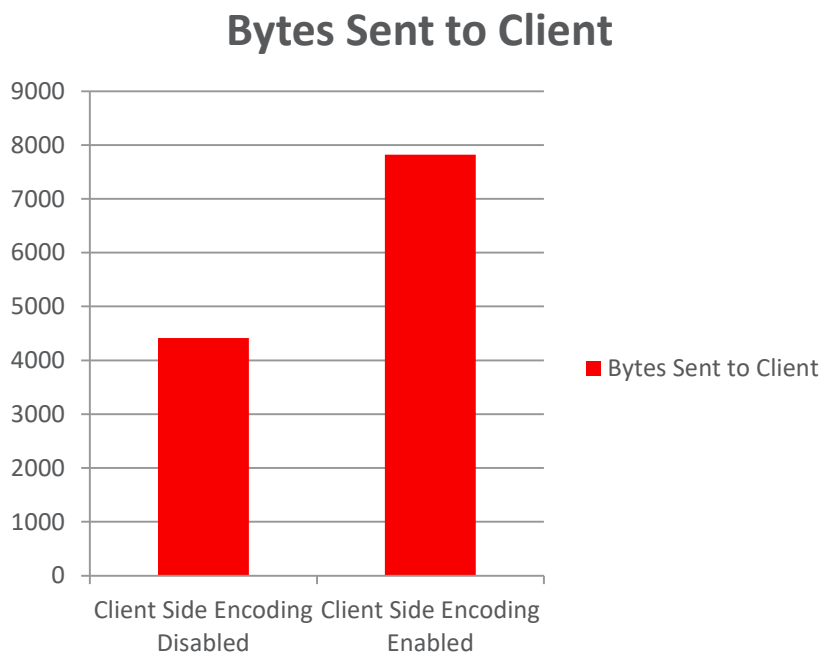
Client Side Encoding : Bytes sent to Server



- 2x bytes read from server
- Client needs token table to encode XML
- Less than .001% of content

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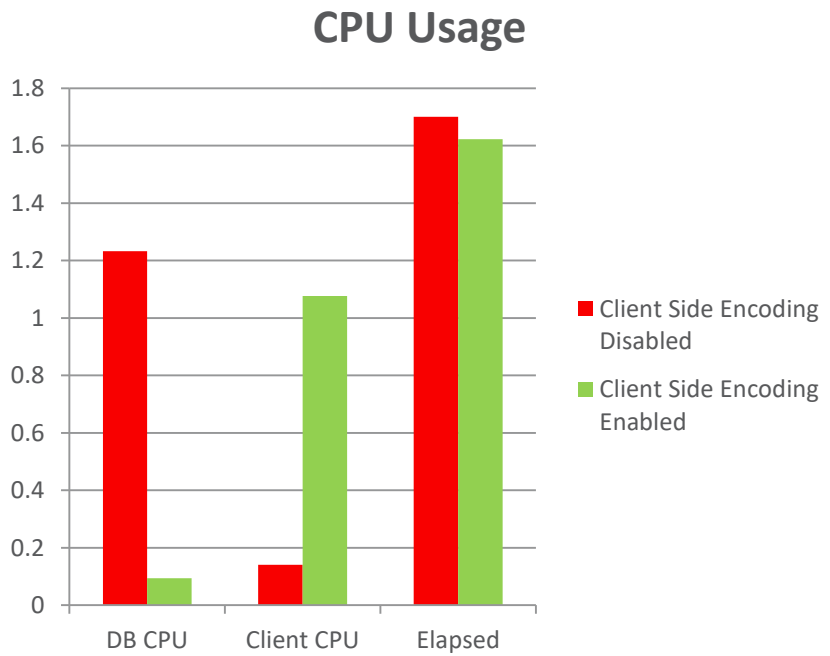
Client Side Encoding : CPU Usage



- 85% reduction in DB CPU
- 8x increase in Client CPU
- 5% reduction in elapsed time
- Significant improvement in scalability

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XML Index : Unstructured Index

```
SQL> create index PURCHASEORDER_XML_IDX
  2     on PURCHASEORDER (OBJECT_VALUE)
  3       indextype is XDB.XMLINDEX;
```

- Requires no knowledge of the structure of the XML being indexed or the search criteria
- All elements and attributes in the XML are indexed
  - Name / Value pair model
- Optimizes searching and fragment extraction
- Accelerates path and path-with-predicate searching
- Supports type-aware searches
- Synchronous and Asynchronous indexing modes

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Path Subsetting

```
SQL> create index PURCHASEORDER_XML_IDX
 2                  on PURCHASEORDER (OBJECT_VALUE)
 3                      indextype is XDB.XMLINDEX
 4                      parameters (
 5                        'paths (
 6                        include (
 7                           /PurchaseOrder/Reference
 8                           /PurchaseOrder/LineItems//* ))‘
 9                      );
```

- Indexing all nodes can be expensive
  - DML Performance & Space Usage
- Path sub-setting allows control over which nodes are indexed
- Trade off retrieval performance, DML performance and space usage

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Structured XML Index

```
SQL> create index PURCHASEORDER_XML_IDX
 2                  on PURCHASEORDER (OBJECT_VALUE)  indextype is XDB.XMLINDEX
 4                      parameters ('PARAM PO_SXI_PARAMETERS');
```

- Indexes “Islands of Structure”
  - Requires some knowledge of the XML being indexed and the kind of queries that will be performed
- Specific leaf-level nodes projected into relational tables
  - Table for each island, leaf node values stored as columns
- Data type aware
- Based on XMLTable syntax()
- Optimizes all SQL/XML operators
  - XMLQuery(), XMLTable() and XMLExists()

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XML Table Index DDL

```
SQL> call DBMS_XMLINDEX.registerParameter(
 2       'PO_SXI_PARAMETERS‘,
 3       'GROUP   PO_LINEITEM
 4            xmlTable PO_INDEX_MASTER
 5              ''/PurchaseOrder''
 6              COLUMNS
 7                  REFERENCE              varchar2(30)              PATH ''Reference'',
 8                  LINEITEM               xmlType                   PATH ''LineItems/LineItem''
 9            VIRTUAL XMLTABLE             PO_INDEX_LINEITEM
10              ''/LineItem''
11              PASSING lineitem
12              COLUMNS
13                  ITEMNO                 number(38)                PATH ''@ItemNumber'',
14                  UPC                    number(14)                PATH “Part/text()'',
15                  DESCRIPTION            varchar2(256)             PATH ''Part/@Description''
16     ');
```

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XML Schema

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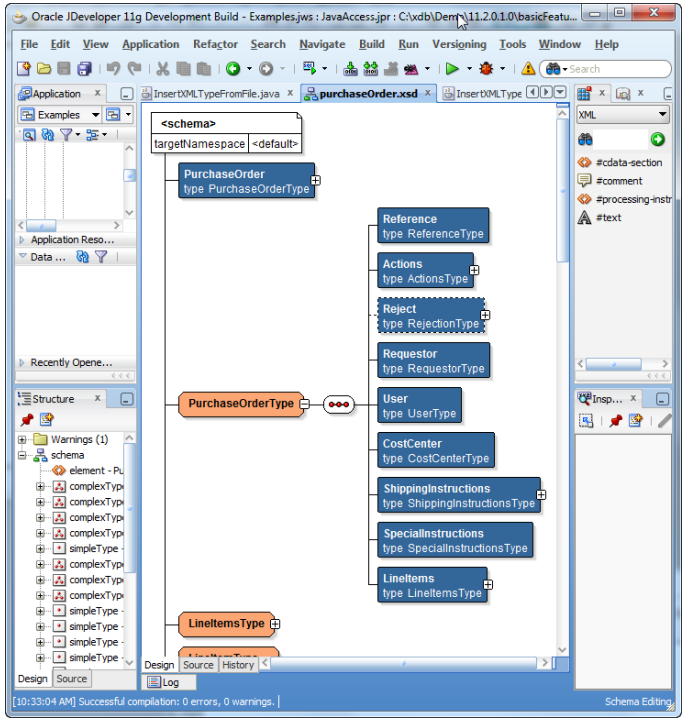
XMLSchema



- WC3 Standard for defining the structure and content of an XML document
  - An XML Schema is an XML document
- Used for validation purposes
  - Parsers like Oracle XDK, XERCES or Microsoft's MSXML
  - XML Editors like XMetal, Oxygene or Microsoft Word 2K7
- Created using tools like Altova's XML Spy or Oracle's JDeveloper

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XML Schema and Binary XML

```
DBMS_XMLSCHEMA.registerSchema  (
   SCHEMAURL              => 'http://www.example.com/xsd/purchaseOrder.xsd',
   SCHEMADOC        => xmlType(bfilename('XMLDIR','po.xsd'), nls_charset_id('AL32UTF8')),
   GENTYPES           => FALSE,
   GENTABLES              => FALSE,
   OPTIONS                => DBMS_XMLSCHEMA.REGISTER_BINARYXML )
```

- Increased storage efficiency for Binary XML
  - Simple types mapped to native formats
  - Pre-generated token tables
- Improves streaming XPath and XML Index operations
  - Leverages cardinality and location information
- Schema validation part of Binary XML encoding process

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Object-Relational Storage

```
DBMS_XMLSCHEMA.registerSchema  (
   SCHEMAURL              => 'http://www.example.com/xsd/purchaseOrder.xsd',
   SCHEMADOC        => xmlType(bfilename('XMLDIR','po.xsd'), nls_charset_id('AL32UTF8')),
   GENTYPES           => TRUE,
   GENTABLES              => TRUE )
```

- XML Schema defines an XML object Model,
- XML Schema compilation
  - SQL object model generated from the XML object model
  - Object-relational tables created to provide efficient storage for SQL objects.
- Object Relational storage enables
  - Lossless, bi-directional mapping between XML object model and SQL object model
  - XQuery execution via re-write into SQL operations on the underlying tables

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Object Relational Persistence

- Suitable for highly structured XML use-cases
  - XML collection hierarchy persisted as master/ details relationships using nested tables
  - Simple recursive structures handled automatically using out-of-line tables
- Near-relational performance for
  - Leaf level access and update
  - Collection manipulation (insert,delete)
- Indexing via B-Tree and Bitmap indexes
- Significant reductions in storage Vs serialized form
- Some overhead incurred for document-level storage and retrieval operations

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XML DB Repository

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Oracle XML DB Repository

- Organize and access content as files in folders rather than rows in tables
  - Manages XML and non-XML content
  - Native support for HTTP, FTP and WebDAV protocols
  - Content accessible using standard desktop Tools
- Enables document-centric development paradigm
  - Path based access to content
  - Queries based on location
- Hierarchical Index
  - Patented, high performance folder-traversal operations and queries

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Oracle DB repository Features

- Document Level Security
  - Highly granular access control
  - Database and application defined principles with custom authentication schemes
- Standards compliant
  - File / Foldering model : IETF WebDav standard
  - Security : DavACL
  - Protocols : HTTP, HTTPS, WebDAV
- Application Development
  - JCR Provider
  - SQL API and Views
  - Database Native Web Services

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Oracle DB repository XML features

- Schema based XML content automatically stored in user tables specified during schema registration
- Enables URL centric standards like XLink and Xinclude
- Special handling for office productivity documents
- Support for virtual documents
  - Based on XMLType views
  - Content generated when document is opened

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Content Management Features

- Access control
  - Grant / Revoke permissions on a document by document basis
- Versioning
  - Simple linear versioning model with Check-In and Check Out
- Comprehensive event model
  - Associate code with operations on files and folders
- Standard and user defined Metadata
  - Manage metadata independently from content
  - Java content management system API

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Database Native Web Services

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Database-native Web Services

- ‘Zero-Development’, ‘Zero-Deployment’ solution for publishing PL/SQL packages.
  - Any package method, function or procedure can be accessed as a SOAP end-point
- Leverages the Oracle XML DB HTTP Server
  - No additional infrastructure required
- Automatic generation of WSDL
  - URL to Package, Function or Procedure mapping scheme
- Uses XML DB infrastructure for processing request and generating response
- Includes ‘SQL Query’ and ‘XQuery’ Services

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Summary

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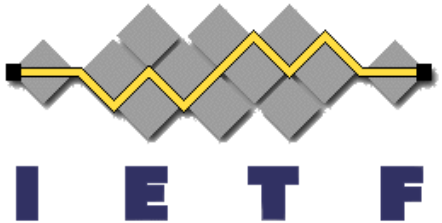
XML DB Summary

- **XMLType**
  - XML storage and indexing
- **XQuery, XML Schema, XSLT**
  - XML centric development
- **SQL/XML**
  - XML publishing
- **XMLDB repository**
  - XML specific content management
- **Standards** compliant
  - Strict adherence and conformance



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Integrated Cloud

Applications & Platform Services

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Q&A

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