Live on Oracle Database 11g XML DB

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The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions.

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Agenda

• XMLDB 11.2 enhancements
  – Schema and XQuery
  – Structured usecases
  – Semistructured and Unstructured usecases
  – Repository

• NCPA demo
XML Use Cases

Structured

“Data-Centric”
Static Schema with Occasional Variability
No ANY or MIXED content

Semi Structured

“Variable Data”
Dynamic & Complex Schema
Islands of ANY or MIXED content

Unstructured

“Doc-centric”
No Schema Variable & Flexible Schema
Repeating ANY & MIXED content
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XML Schema Enhancements

- **Schema registration performance**
  - Eliminate internal and external memory fragmentation
  - Optimized schema loading
  - Time and memory improved by 50x for US-GAAP, HL7, NIEM

- **Schema Validator Cache**
  - Improves XML schema validation by around 5x, more for small docs

- **Can handle complex industry schemas**
  - GJ-XML, GML, US GAAP, NIEM, HL7, FixML, MPEG-7, KML
  - ACORD, SDMX, FPML, Reed, OAGIS, MPEG7: Binary & O-R
XML Schema
Performance Improvements over 11gR1

Avg. improvement for
NIEM, HL7, US GAAP, FPML
XQuery and SQL/XML

Storage Independent Enhancements

• XQuery 1.0 / SQL/XML standard compliant
• Handling Large XQueries
  – Re-write enabled for large size Xquery (upto 32K)
  – 8x increase in size and complexity of supported XQuery operations
• 20x improvement in functional evaluation of Xquery
• Up to 60x improvement for XML Generation from relational data
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Object-Relational Storage Enhancements

- Inheritance constructs like xsi:type and “instance of” now rewrite
- Default storage of collections is “table” across the board
  - leads to relational query performance
- Document ingestion and fragment retrieval faster and more scalable
Ingestion of Large Documents in Object-Relational Storage

- Files upto 4G can be ingested in an O-R table
  - up from 500M pre-11gR2
- “Direct Insert” : Greedily flushes document fragments directly to destination tables
- Scalable and Performant
  - Minimizes fragments in memory
- Applied when documents are uploaded to XDB using
  - FTP protocol
  - PL/SQL function DBMS_XDB.createResource
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XML Index Table-based (New in 11gR2)

Example

**XML Data**

```xml
<Address>
  <city>Fremont</city>
  <state>CA</state>
</Address>....

<Address>
  <bold> <city>Melbourne</city></bold>
  <font size="21">
    <state><!– state is not in US -->
    </state>
  </font>
  <country>Australia</country>
</Address>
```

**XML Table Index**

<table>
<thead>
<tr>
<th>Key</th>
<th>City</th>
<th>State</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Fremont</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Melbourne</td>
<td>Australia</td>
<td></td>
</tr>
</tbody>
</table>
XMLIndex Table-based

- Complements Path based XML Index
- Project commonly searched structured data into a table
- Secondary relational indexes can be created on top of index content tables
- Text Index can be created on projected text column
  - Speed up text search in XML content
- Rewrites queries for relational performance
XMLIndex Path-based Enhancements

- Partitioning, parallel index creation and parallel query supported
- Physical rewrite for path subsets
- Many queries improve 5-20x
- Asynchronous DML performance improves 2.5x
Binary XML Enhancements

- Improved query performance without indexes
  - New Search based decoder
  - Document level Summary
  - Improved XPath Caching
- Improved End to End Binary XML performance for Thin and OCI drivers
  - Caching of Tokens on the client side.
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XML DB Repository
Enhancements

• Secure files for all repository content
• Create Operations
  – Improved creation performance of documents conforming to system schemas (ACLs etc).
  – Avoid creating intermediate DOMs while creating resources
  – Optimized in-memory structures
• Retrieval
  – Improved resource_view queries where predicates involve equals_path and under_path – 3x improvement.
  – Avoid copies during full retrieval of documents - 2-3x improvement.
• Delete
  – ACL Deletion performance increase by 5x using ACL OID Index on resources.
XML DB Repository
Performance Improvements over 11gR1

Create: 1.5x, Delete: 1.1x, Update: 1.6x, Query(equals_path): 3x, Full Read: 3.3x, Non-XML: 5x
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Northern California Power Agency (Structured)

- NCPA supplies and purchases power from the California grid on behalf of its members.
- Settlement system leverages SOA and XML.
- “XML DB Short Circuits the Data Transformation”
  - NCPA is able to process large volumes of XML using commodity hardware.
  - System has proven flexible and adjusts quickly to ongoing changes.
  - Source code available as ‘open-source’ – being adopted by other market participants.
- In-house solution developed at a fraction of the cost of an off-the-shelf solution.
- Currently live on 11gR1 with RAC.
Live on Oracle Database 11g XML DB

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Brief Background on NCPA

- NCPA supplies and purchases in the California grid on behalf of its 16 cities in Northern California
- Our load is about 1000 MW
- We celebrate 41 years of service this year
- Our members’ value is derived in large part from:
  - Our ability to be a cost leader
  - Our ability to be agile under different market conditions and regulations
Start of XMLDB Project

- CAISO was formed in 1997 as a result of market restructuring in California
- The meltdown of 2000 formed the basis for the current Market Redesign.
- The aging equipment at the CAISO was the basis for a system refresh of the equipment and technology under MRTU.
- Web Services, B2B Communication and XML Payload Delivery
Project Challenges for NCPA and MRTU

MRTU Challenges
- Evolving Requirements
- Complex Market
- Large Payloads

Business Challenges
- High Reliability
- Agility Built In
- Cost Control
XML DB Short Circuits the Data Transformation

**XML DB**
- Register XSD
- Load XML
- Write Queries

**Traditional Approach**
- Design Tables
- Build Tables
- Parse Data
- Write Queries
DEMO

- XML Schema Registration
- XMLType tables generated from the registration
- Loading XML Instances
- Xquery Views
- In-Place Schema Evolution
- Copy-Evolve Schema Evolution
- Schema-Based Binary XML
BillDeterminantData.xsd Schema Evolution

Solution:
DBMS_XMLSCHEMA.InplaceEvolve()
StatementData.xsd Schema Evolution

OLD

NEW

Solution:
DBMS_XMLSCHEMA.CopyEvolve()
Major Systems Built

- 26 Different Systems Were Impacted
- Major Systems Built For MRTU:
  - Bidding System
  - Settlement System
  - Master File System
  - Dispatch Retrieval System
Costs

- Hardware, Software, and Third Party Components
  - $300 thousand (one time cost)
- Labor (two year effort)
  - $900 thousand (internal)
- $1.2 Million Invested
- $250K Per System…..A Real Bargain
Hardware and Software Configuration

- 64-bit Windows Server 2003 SP 2 on 2 Intel Xeon 5160 dual-core CPUs, with 8 GB of RAM.
- The database is 220 GB (today).
- The Oracle software is Oracle Database 11g Release 11.1.0.7.0 – 64bit Production
End
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