Fast Delivery of Intelligent BI Solutions

Marty Gubar
Oracle BI/DW Product Management
Agenda

• The Requirement: Intelligent Ad hoc Data Exploration
• Overview: Embedded OLAP in Oracle Database 11g
• Calculation Capabilities Scale to Business Requirements
• Advanced Analytic Queries Using Simple SQL
• Ad hoc Analysis Using Excel and OBIEE
The Requirement
Example Report

Calculations include:
- Time-series
- Comparison to peers (i.e. share)
- Alerts (uncover issues at levels below current selection)
- Statistical Forecasts
- … and multiple layers of nested calculations
- … at any level of detail

<table>
<thead>
<tr>
<th>Sales Revenue Analysis</th>
<th>Q1-CY2009</th>
<th>Q2-CY2009</th>
<th>Q3-CY2009</th>
<th>Q4-CY2009</th>
<th>Q1-CY2010</th>
<th>Q2-CY2010</th>
<th>Q3-CY2010</th>
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Oracle Database 11g
The Optimal Information Platform

- Cohesive, integrated database platform
- Secure, highly available, scalable and manageable
- Rich analytic platform
World's First Database Machine
Using Sun FlashFire Technology

• Extreme performance for data warehousing
• Pre-installed and configured system out of the box
• Extends suite of Oracle Database 11g functionality
Oracle Database 11g: Embedded OLAP
Simplify Heterogeneous Query Environments

- Business rules in Oracle Database
  - Single definition shared by all client tools and applications
  - Available in Oracle data dictionary

- Calculation complexity pushed into analytic engine in the database
  - Calculations leverage dimensional metadata
  - Simplifies implementations
  - Delivers efficient computation
Oracle Database Metadata

Table Relationships

- **REGION**
- **SALES FACT**
- **INVENTORY**
- **ITEM**
- **CUST**
- **TIME**
Column Relationships
Not Captured in Table’s Metadata
Value of Dimensional Metadata
Dimensions Formalize Data Relationships

- CUST
- SALES FACT
- INVENTORY
- TIME
- REGION

Geography

Product

Time
Value of Dimensional Metadata

Dimensions Formalize Data Relationships

Define the business relationships

<table>
<thead>
<tr>
<th>CUST</th>
<th>REGION</th>
<th>SALES FACT</th>
<th>INVENTORY</th>
<th>ITEM</th>
<th>TIME</th>
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</table>

<table>
<thead>
<tr>
<th>Product</th>
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<th>Item</th>
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</thead>
<tbody>
<tr>
<td>Level-based Hierarchy</td>
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</tr>
</tbody>
</table>

- Geography
- Time
Value of Dimensional Metadata
Dimensions Formalize Data Relationships

- Region
- Geography
- Time
- Product
- Complex Hierarchy

Model complex hierarchical relationships
Value of Dimensional Metadata

Dimensions Formalize Data Relationships

- Geography
- Time
- Product
- Hierarchical Relationships
- Use family references to simplify calculations

SALES FACT
INVENTORY
ITEM
TIME
CUST
REGION
Value of Dimensional Metadata

Time Dimension Supports Any Calendar Type

Time dimension simplifies time-series calculations
Value of Dimensional Metadata

Dimensions Shared Across Cubes

Sales Cube
- Product
- Time
- Geography

Inventory Cube
- Product
- Time

SALES FACT
- Time
- Geography

INVENTORY
- Product

SALES FACT
- Time

INVENTORY
- Product

TIME
- Product

CUST
- Product

ITEM
- Product
Value of Dimensional Metadata

Aggregation Rules

SUM Aggregation Rules
Product: Sum
Geography: Sum
Time: Sum

SUM Aggregation Rules
Product: Sum
Time: Hierarchical Last
Value of Dimensional Metadata

Analytic Calculations Leverage Metadata

Calculations
- Sales
- YTD
- YTD % Change
- Share YTD
- Share YTD % Chg
- Forecast
- Moving Average
- ...

Calculations
- Balance
- Inventory Cost
- Stock Out
- ...

Product

SALES FACT

INVENTORY

TIME

CUST

REGION

TIME

Geography

Inventory Cube

Sales Cube
Calculation Glide-Path
Solution Scales as Calculation Complexity Grows

Calculation definition options support most any analytic calculation requirements:

1. Calculation Templates
2. Calculation Expression Syntax
3. OLAP DML Programs, Functions and Models
Calculation Templates

Choose from a wide range of common business calculations

- **Addition**
  - Simple Math
  - Subtraction
  - Multiplication
  - Division (Ratio)
  - Percent Difference
  - Index

- **Prior and Future Periods**
  - Prior Period
  - Difference from Prior Period
  - Percent Difference from Prior Period
  - Future Period
  - Difference from Future Period
  - Percent Difference from Future Period

- **Period To Date**
  - Period To Date
  - Period To Date Period Ago
  - Difference from Period To Date Period Ago
  - Percent Difference from Period To Date Period Ago

- **Parallel Period**
  - Parallel Period
  - Difference from Parallel Period
  - Percent Difference from Parallel Period

- **Share and Ranking**
  - Share
  - Rank

- **Moving Aggregates**
  - Moving Total
  - Moving Average
  - Moving Maximum
  - Moving Minimum

- **Cumulative Aggregates**
  - Cumulative Total
  - Cumulative Average
  - Cumulative Maximum
  - Cumulative Minimum
Customize the Calculation

Create Calculated Measure

Specify General Calculated Measure Information

Name: PRODUCT_RANK_PCT_CHO_YTD
Short Label: Product Rank by % Chg Sales YTD
Long Label: Product Rank by % Chg Sales YTD
Description: Product Rank by % Chg Sales YTD
Calculation Type: Rank

Calculation:
Rank members of the PRODUCT dimension and PRODUCT STANDARD hierarchy based on measure SALES_YTD_PY_PCT_CHO ().
Calculate rank using RANK method with context in order highest to lowest. Rank NA(null) values null last.

Expression:
RANK() OVER HIERARCHY (PRODUCT_STANDARD ORDER BY SALES_CUBE.SALES_YTD_PY_PCT_CHO DESC NULLS LAST WITHIN PARENT)
Easy to define nested calculations

Start with Sales

Sales YTD

Accumulate Sales for the year

Sales YTD % Chg Pr Year

Compare YTD Sales to last year

Rank Products w/in Parent

Rank products by Sales YTD % Chg Pr Year
Calculation Expression Syntax

• OLAP Expression Syntax:
  • Patterned after SQL analytic and window functions
  • Extended to leverage unique properties of OLAP model
  • Can leverage OLAP DML code
Calculation Expression Syntax

Similarity to Standard SQL Syntax

• Identical to SQL syntax for:
  • Single Row Functions
    • Approximately 90 single row functions are identical to SQL
    • Examples: nvl, nullif, to_date, ||, replace, etc.
  • Conditional Statements
    • Supports standard comparative operators
    • Examples: case, decode, <, <=, =, >, >=, !=, etc.
Calculation Expression Syntax
SQL Syntax Extended for OLAP Metadata

- Enables a single calculation to span various levels of aggregation
- Leverages native understanding of hierarchical relationships
- Requires no densification for time-series calculations
- Includes the following functions:

<table>
<thead>
<tr>
<th>Function</th>
<th>Function</th>
<th>Function</th>
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<tbody>
<tr>
<td>AVERAGE_RANK</td>
<td>HIER_PARENT</td>
<td>MAX</td>
</tr>
<tr>
<td>AVG</td>
<td>HIER_TOP</td>
<td>MIN</td>
</tr>
<tr>
<td>COUNT</td>
<td>LAG</td>
<td>RANK</td>
</tr>
<tr>
<td>DENSE_RANK</td>
<td>LAG_VARIANCE</td>
<td>ROW_NUMBER</td>
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<td>HIER_ANCESTOR</td>
<td>LAG_VARIANCE_PERCENT</td>
<td>SHARE</td>
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<td>HIER_CHILD_COUNT</td>
<td>LEAD</td>
<td>SUM</td>
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<td>HIER_DEPTH</td>
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<td>HIER_LEVEL</td>
<td>LEAD_VARIANCE_PERCENT</td>
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</tr>
</tbody>
</table>
Calculation Expression Syntax

Example of Extended SQL Syntax

Window function example (RANK)

- One OLAP Expression is equivalent to several SQL rank expressions

--OLAP
- Rank within parent at any level
RANK() OVER HIERARCHY (PRODUCT.STANDARD ORDER BY SALES_CUBE.QUANTITY DESC NULLS LAST WITHIN PARENT)

--SQL
--Rank departments
RANK() OVER (PARTITION BY total_product_id ORDER BY sales DESC NULLS LAST)
--Rank categories
RANK() OVER (PARTITION BY department_id ORDER BY sales DESC NULLS LAST)
--Rank types
RANK() OVER (PARTITION BY category_id ORDER BY sales DESC NULLS LAST)
--Rank sub types
RANK() OVER (PARTITION BY type_id ORDER BY sales DESC NULLS LAST)
--Rank items
RANK() OVER (PARTITION BY sub_type_id ORDER BY sales DESC NULLS LAST)
Calculations Using OLAP DML

- OLAP DML is a dimensionally aware procedural programming language
  - Supports looping, conditional logic, multidimensional selection and more
  - Includes hundreds of analytic functions
- OLAP DML can be used:
  - Within a custom measure expression
  - To assign data to stored measures within a cube
    - Forecasts
    - Allocations
    - Systems of expressions (a.k.a ‘models’)
    - Assignments based on user defined expressions
Calculations Using OLAP DML

Example: Product Alert

“Look at product sales for the children of the current product limit product to children using product_parentrel_product

“Have any products fallen compared to last year? _alert = ANY(sales_cube_sales_py_pct_chg lt 0, time channel geography)

return _alert
Cubes Exposed as a “Star”

- Single cube view contains many summary levels
- Calculations exposed as columns and computed in OLAP engine

- Fact table contains leaf data
- Calculations computed in relational engine using functions in select list
Basic Query:

```sql
SELECT c.long_description as chan,
       p.long_description as prod,
       t.long_description as time,
       s.sales
FROM channel_sales_channel_view c,
     product_standard_view p,
     geography_regional_view g,
     time_calendar_view t,
     sales_cube_view s
WHERE c.dim_key = s.channel
  AND g.dim_key = s.geography
  AND p.dim_key = s.product
  AND t.dim_key = s.time
  AND c.level_name = 'CLASS'
  AND g.level_name = 'ALL_REGIONS'
  AND p.level_name = 'DEPARTMENT'
  AND t.dim_key in ('CY2009')
```

Analytic Query:

```sql
SELECT c.long_description as chan,
       p.long_description as prod,
       t.long_description as time,
       s.sales,
       s.sales_ytd,
       s.sales_ytd_py_pct_chg,
       s.product_alert
FROM channel_sales_channel_view c,
     product_standard_view p,
     geography_regional_view g,
     time_calendar_view t,
     sales_cube_view s
WHERE c.dim_key = s.channel
  AND g.dim_key = s.geography
  AND p.dim_key = s.product
  AND t.dim_key = s.time
  AND c.level_name = 'CLASS'
  AND g.level_name = 'ALL_REGIONS'
  AND p.level_name = 'DEPARTMENT'
  AND t.dim_key in ('CY2009','APR2009')
```
### Turn Application Express into a BI Tool

**APEX Interactive Report:**

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Time</th>
<th>Sales</th>
<th>Product Alert</th>
<th>% Chg PY</th>
<th>YTD</th>
<th>YTD % Chg PY</th>
<th>YTD Share % of Prod</th>
<th>YTD Share % Chg PY</th>
<th>Best Hit Forecast</th>
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<tbody>
<tr>
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</tr>
</tbody>
</table>

1. **Drill down on any dimension**
2. **Calculations work perfectly across all summary levels**
Generate OBIEE Metadata Over Cubes

AWM Plug-in Automates Process

Export cube metadata to OBIEE Administrator
OBIEE Answers Leverages OLAP Calculations Computed in OLAP Engine

<table>
<thead>
<tr>
<th>Department</th>
<th>Calendar Quarter</th>
<th>Sales</th>
<th>Sales YTD</th>
<th>YTD Pr Year</th>
<th>VTD % Chg Pr Year</th>
<th>3 Per Moving Total</th>
<th>Target</th>
<th>% of Target</th>
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Analyze Cubes Using Excel
Simba MDX Driver Connects to OLAP

1. Reads Oracle Data Dictionary for metadata
2. Generates optimized queries against cube

http://www.simba.com/
Summary

• Oracle OLAP improves the delivery of information rich queries by SQL-based tools and applications
  • Simple definition of analytic calculations
  • Simple access to analytic calculations
  • Fast performance
  • Leverage existing Oracle Database expertise
For More Information

search.oracle.com

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