



## A Future Oracle BI/DW Architecture

Mark Rittman, Director, Rittman Mead Consulting  
Philadelphia Oracle Users Group, October 2008

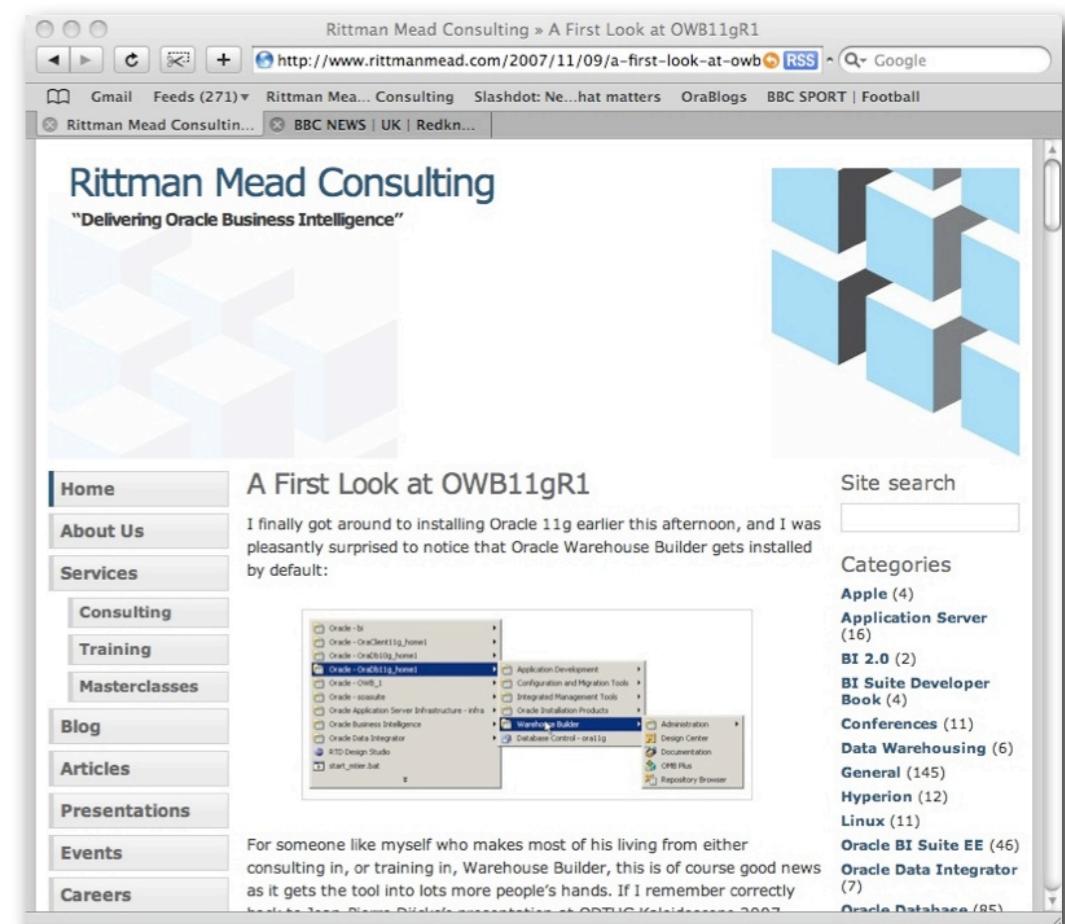
## Who Am I?

- Oracle BI&W Architecture and Development Specialist
- Co-Founder of Rittman Mead Consulting
  - ▶ Oracle BI&W Project Delivery Specialists
- 10+ years with Discoverer, OWB etc
- Oracle ACE Director, ACE of the Year 2005
- Writer for OTN and Oracle Magazine
- Longest-running Oracle blog
  - ▶ <http://www.rittmanmead.com/blog>
- Chair of UKOUG BIRT SIG
- Co-Chair of ODTUG BI&DW SIG
- Speaker at IOUG and BIWA events



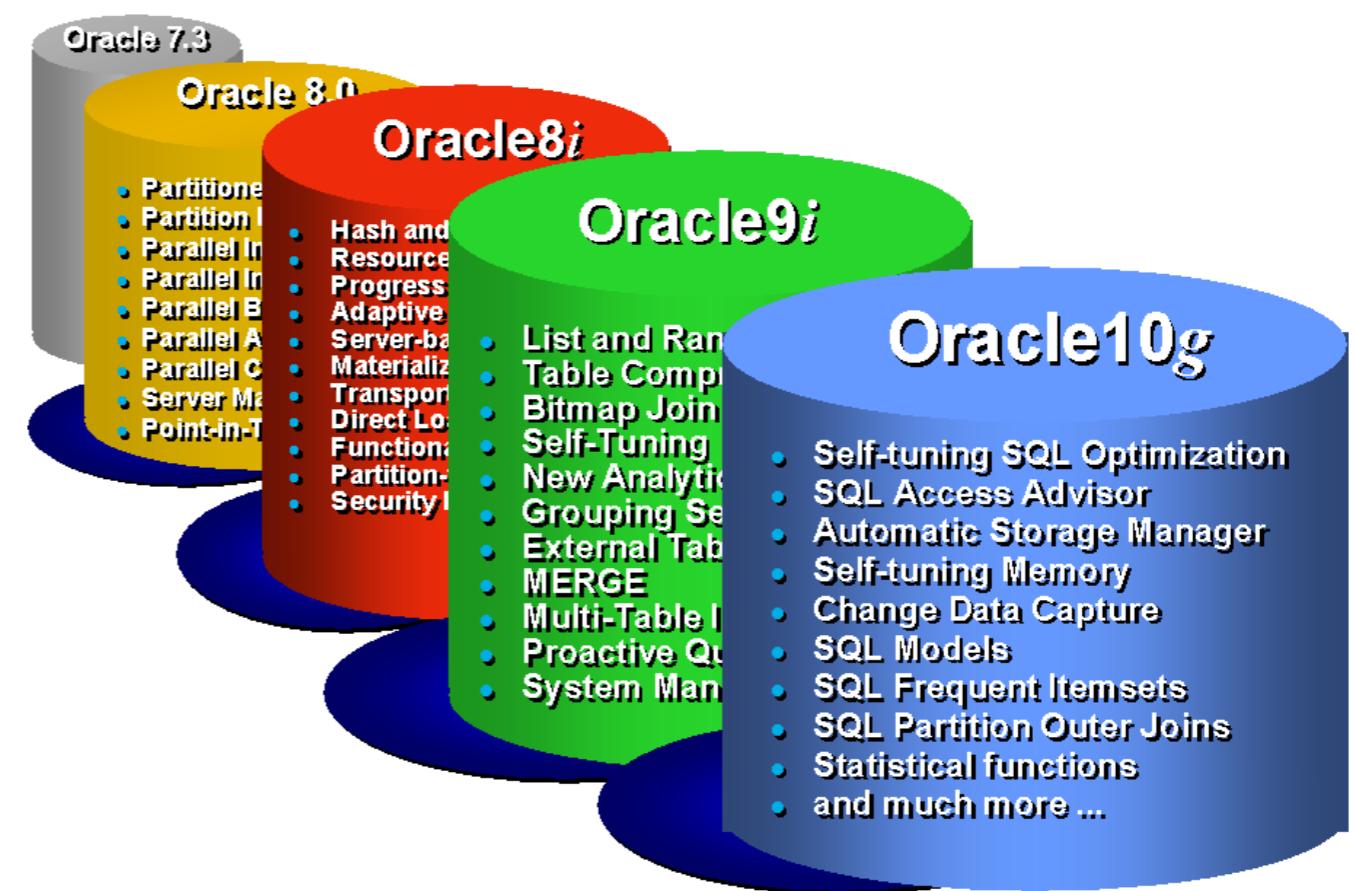
# Rittman Mead Consulting

- Oracle BI&DW Project Specialists
- Consulting, Training, Support
- Works with you to ensure OBIEE project success
- Small, focused team
- OWB, Oracle BI, DW technical specialists
- Clients in the UK, Europe, USA



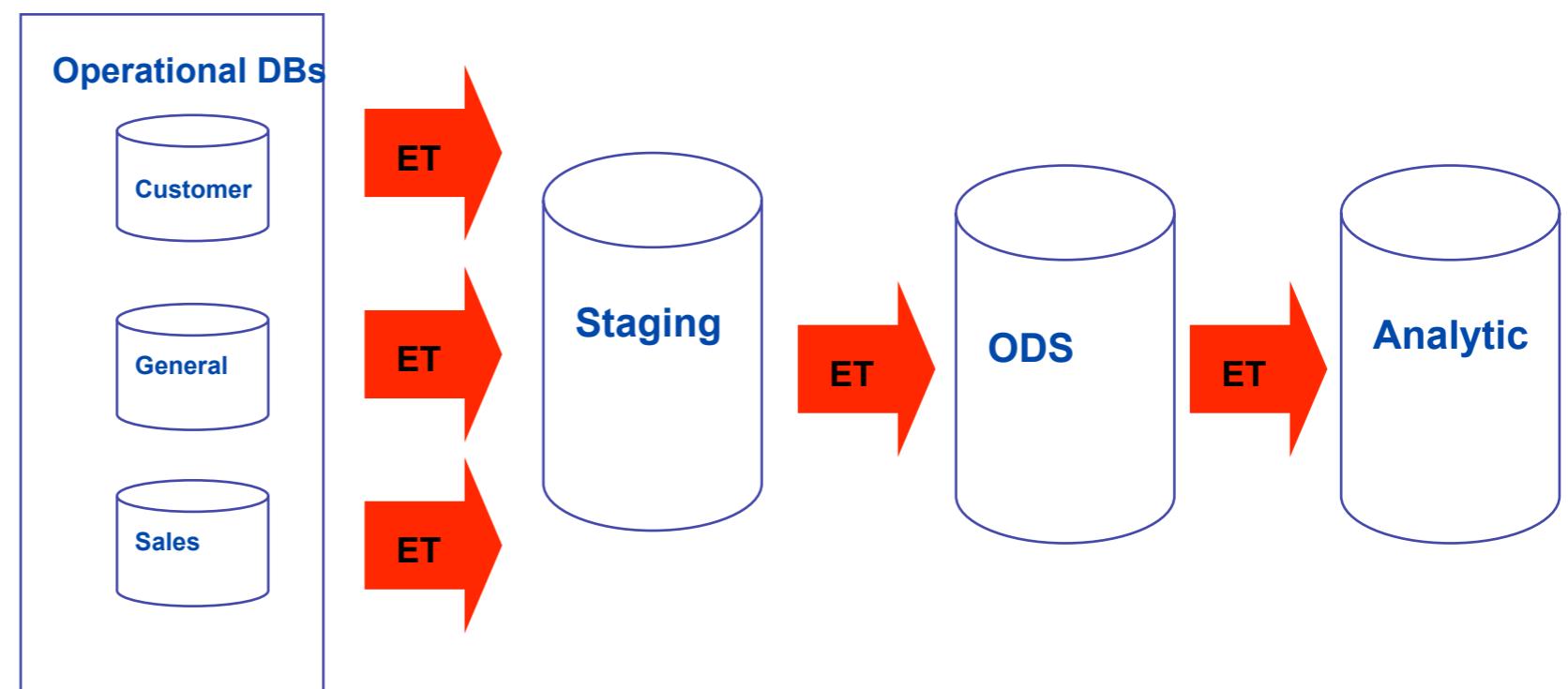
# Oracle Database Key Features for Data Warehousing

- Partitioning
- Parallel Query & DML
- Segment Compression
- Bitmap Indexes
- Materialized Views
- Star Transformations
- OLAP Option
- Data Mining Option
- Oracle Warehouse Builder
- Oracle Warehouse Builder Core Functionality



## The Traditional Three-Layer Data Warehouse Design

- Data is extracted from source systems, and copied into a Staging Area
- Staging data is then processed, transformed and integrated within this area
- Transformed, detail-level data is then optionally loaded into an Operational Data Store or Process-Neutral Data Store
- Detail-level transformed data is then loaded into the (dimensional) Analytic Layer



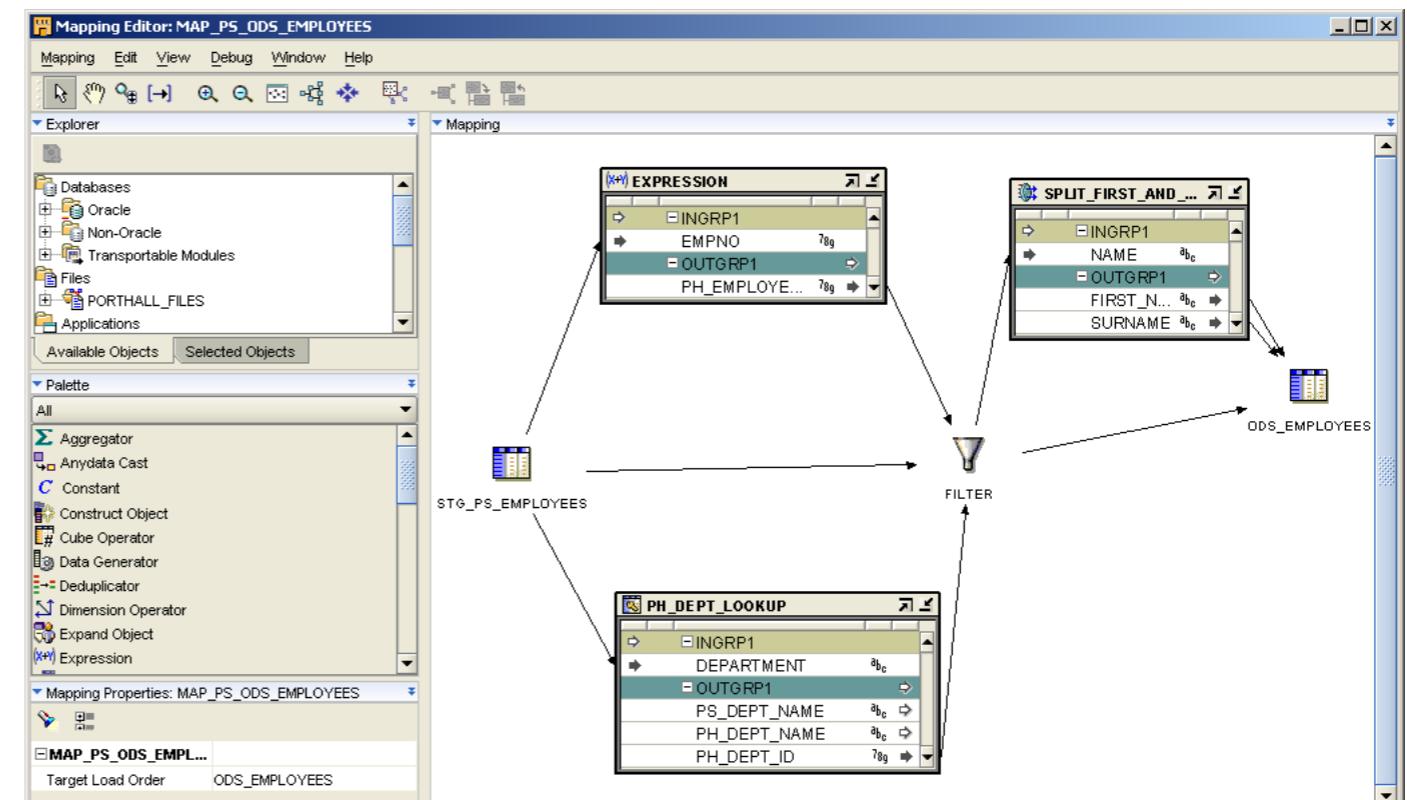
## Typically Loaded Using Oracle Warehouse Builder

---

- Data is often extracted, transformed and loaded using an ETL tool
  - ▶ Oracle Warehouse Builder, comes free with the Oracle Database
- Generates SQL and PL/SQL
- Aids team-based development
- Repository-based
- Automatically uses Oracle DW features (DML Error logging etc)
- Alternative tools, and development using SQL and PL/SQL also common

## Typically Loaded Using Oracle Warehouse Builder

- Data is often extracted, transformed and loaded using an ETL tool
  - ▶ Oracle Warehouse Builder, comes free with the Oracle Database
- Generates SQL and PL/SQL
- Aids team-based development
- Repository-based
- Automatically uses Oracle DW features (DML Error logging etc)
- Alternative tools, and development using SQL and PL/SQL also common



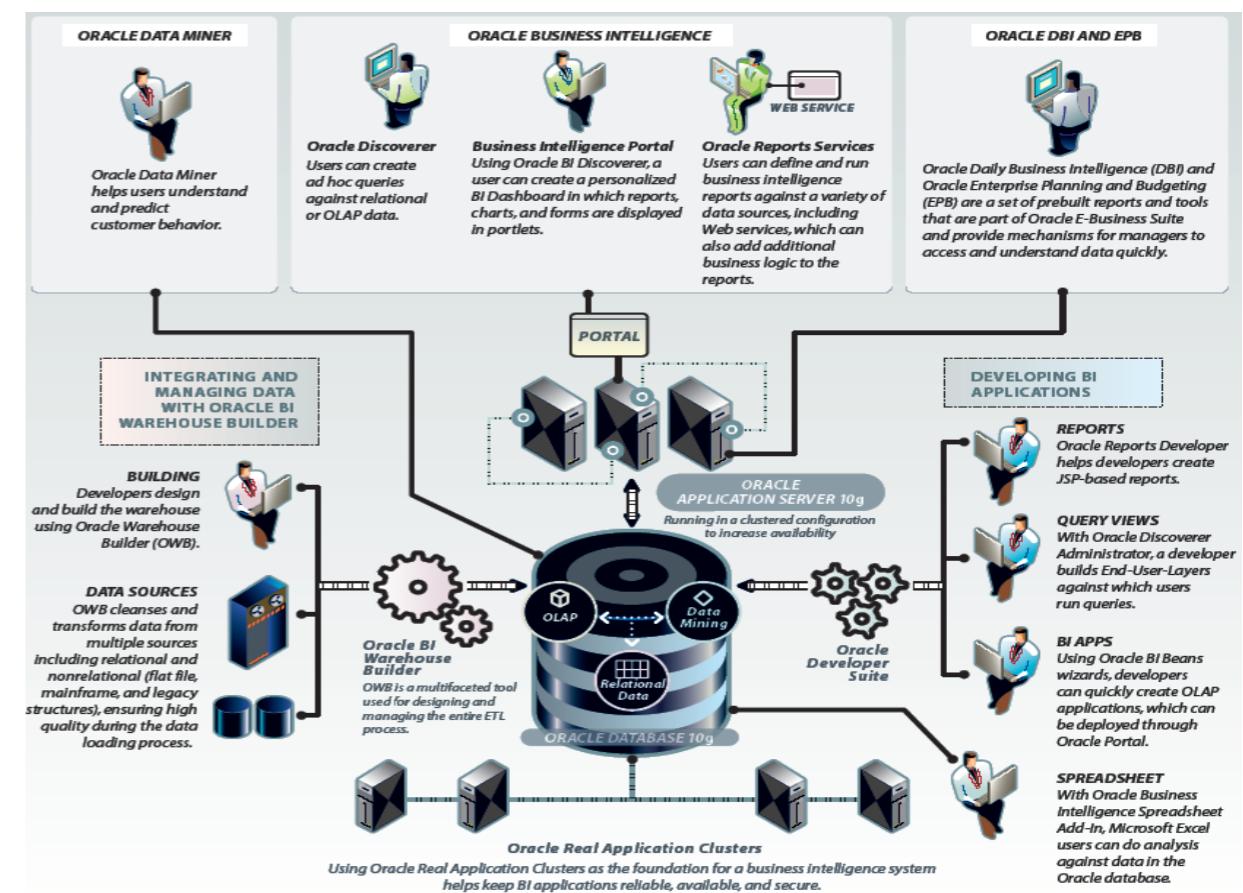
## Common Data Warehouse Areas of Focus

---

- Getting the initial design right
- Extracting and loading data into the warehouse
- Indexing for fast access to detail-level data
- Handling of very large databases
- Efficient querying of large volumes of data
- Providing fast access to summarized data
- Optimization of queries and the ETL process

## The Typical Oracle 10g-era Data Warehouse

- Hosted on a single Unix server, some now being hosted on blade + RAC servers
- Data increasingly stored on SANs and NASs
- Use of Oracle Database 10g Enterprise Edition, Partitioning Option, OLAP Option
- Oracle Enterprise Manager, some use of Oracle Grid Control
- Oracle Warehouse Builder + shell scripts
- Oracle Discoverer, Oracle Portal, Oracle Reports
- Data sourced from EBS and COTS applications



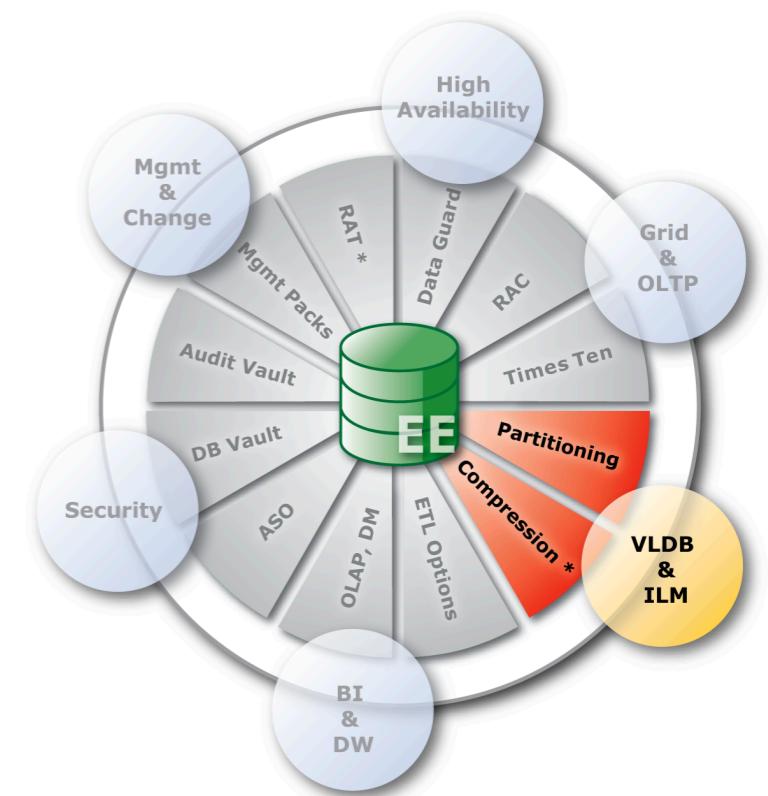
## New Features in Oracle Database 11g and 10gR2

- More partitioning options
- Advanced Compression
- Cube Organized Materialized Views
- Virtual Columns
- DML Error Logging
- Embedding of Oracle Warehouse Builder

**ORACLE® 11g**  
DATABASE

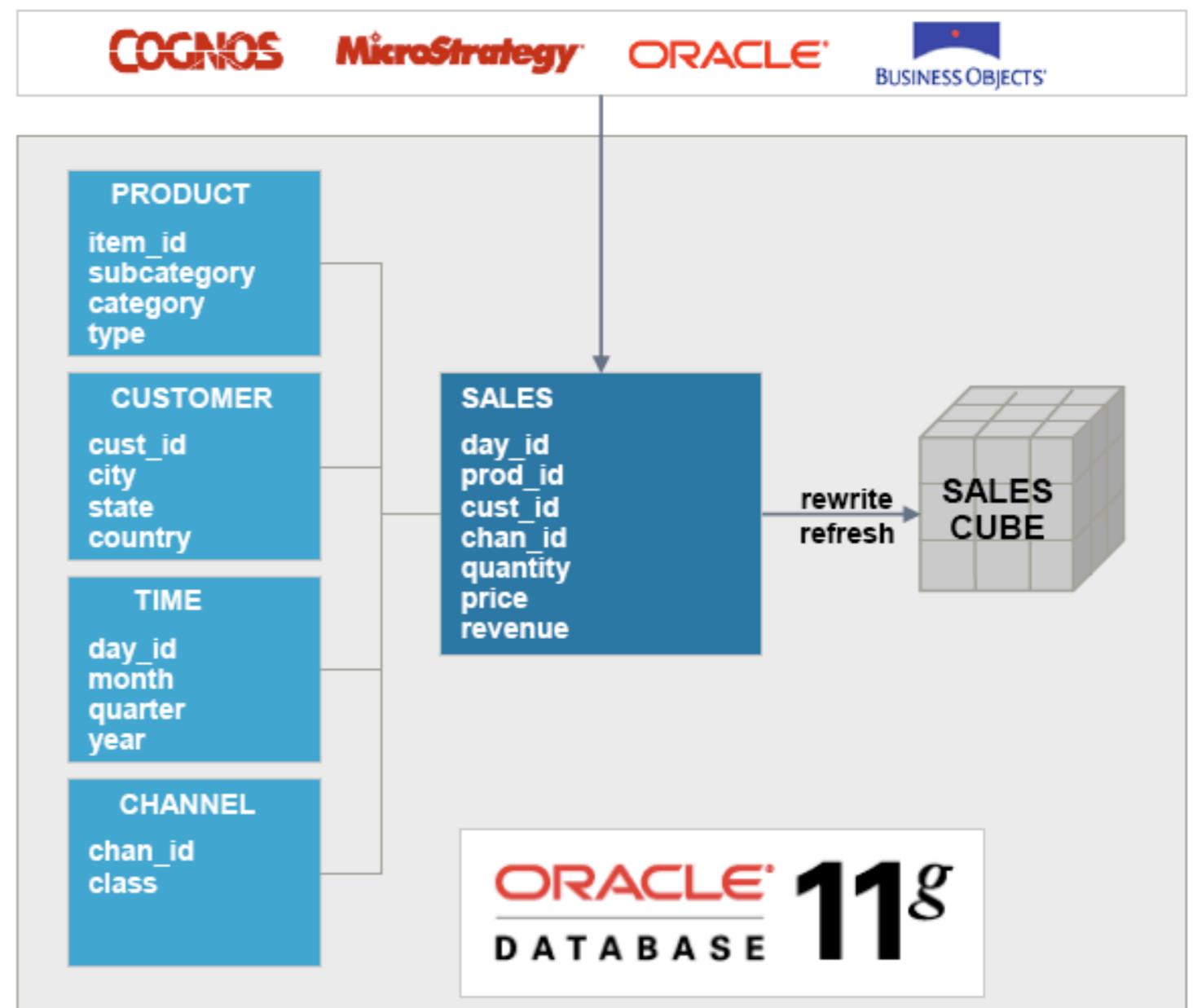
# New Partitioning Features in Oracle Database 11g

- Interval Partitioning
  - ▶ Automatic creation of range-based partitions
- REF Partitioning
  - ▶ Partition detail table based on the master-table key
- Virtual-Column Based Partitioning
  - ▶ Partition based on an expression



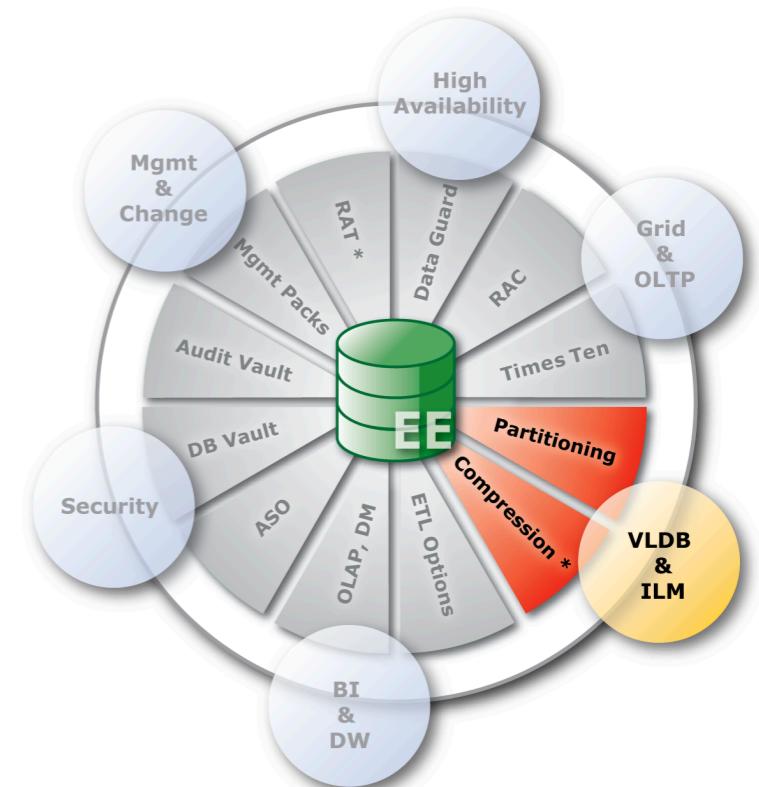
## New in Oracle Database 11g : Cube Organized Materialized Views

- Summaries can now be stored in a single Oracle OLAP multidimensional cube
- A single cube can contain the equivalent of thousands of summary combinations
- The Oracle 11g CBO treats OLAP cubes as MVs and rewrites queries to access cubes transparently
- Cubes refreshed using standard MV procedures



## New In Oracle Database 11g : Advanced Compression

- Oracle Database 11g introduces the Advanced Compression Option
- Provides compression for the following data types
  - ▶ OLTP relational data (supports **INSERT**, **UPDATE**, **DELETE** and retains compression)
  - ▶ Unstructured data through SecureFiles (replacement for LOBs)
  - ▶ Backups
- OLTP performance is unaffected as the blocks can be read in their compressed form
  - ▶ Performance is actually likely to improve as more data per block (reduced I/O)



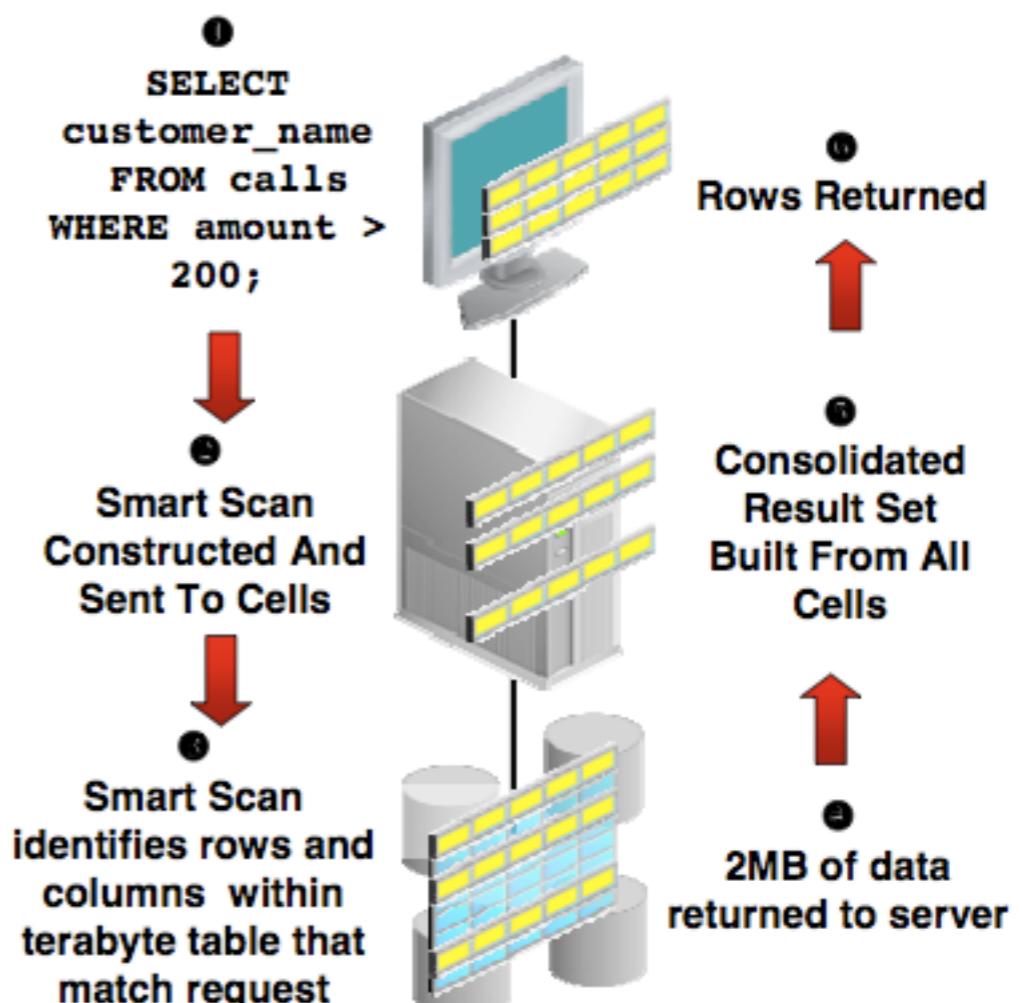
## Oracle Database Machine and Oracle Exadata Storage Server

- New hardware initiative in association with HP
- Dedicated storage server, filters data at disk level
- Balanced disk and network capacity
- New enhancements delivered through 11.1.0.7 patchset
- Exadata Storage Server available standalone, or as part of HP Oracle Database Machine appliance
- Aimed at DW Appliance market



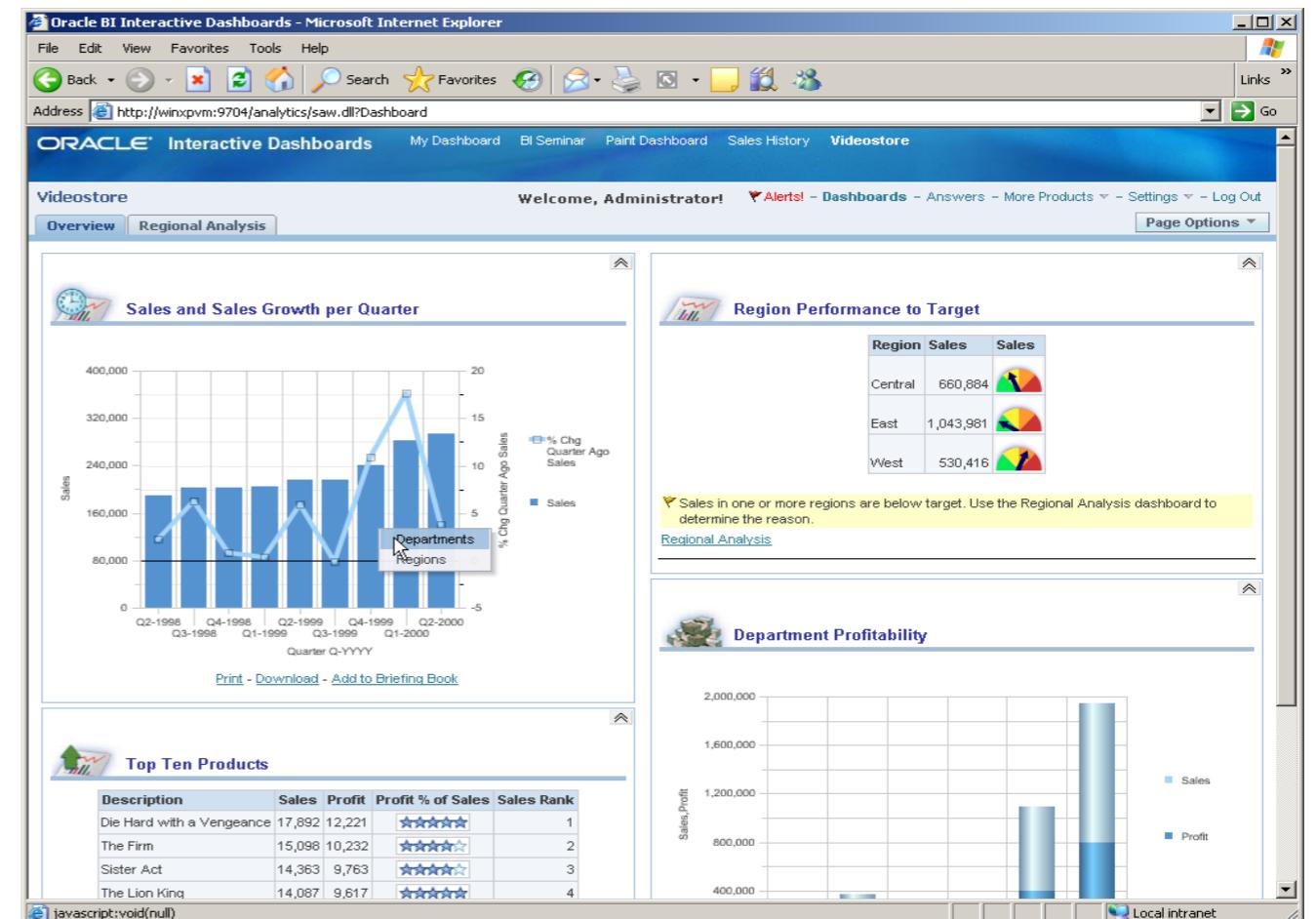
## Exadata “Smart Scan” Processing

- Exadata Storage Server “Cells” offload the predicate evaluation from the DB server
  - ▶ Only returns relevant rows
  - ▶ Only returns relevant columns
  - ▶ Join filtering
  - ▶ Incremental backup filtering
- Data reduction of around 10%
- Reducing in CPU load
- Filters are pushed to the disk unit



# Oracle Business Intelligence Enterprise Edition Plus

- Dashboards, Answers, Delivers, Oracle BI Server
- Complete set of web-based query, reporting and analysis tools
- Now comes with Hyperion front-end tools (OBIEE+)
- Based on Siebel Analytics
- Heterogeneous database access
- Logical Business Model
- Data integration capabilities



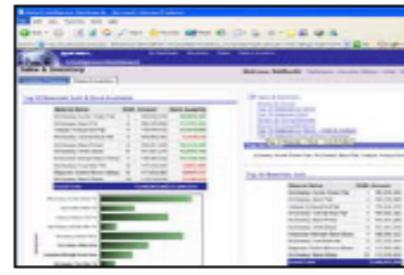
## Hot-Pluggable and Standards-Based

### Portals



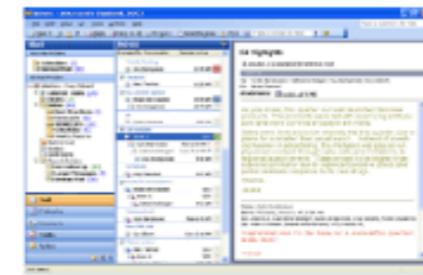
Any JSR 168 Portal

### Data Mining



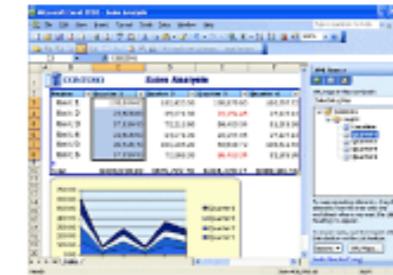
Oracle Data Mining,  
SPSS, SAS

### Applications



Oracle EBS, Siebel, SAP,  
PeopleSoft, JD Edwards ..

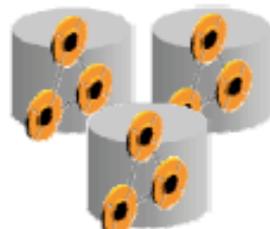
### Desktop Tools



Excel, Outlook,  
Lotus Notes ..

## Oracle Enterprise Performance Management System Oracle Business Intelligence Foundation

### Security



Oracle  
Kerberos  
iPlanet  
MSFT AD  
Novell  
Custom  
Others ..

### Data Access



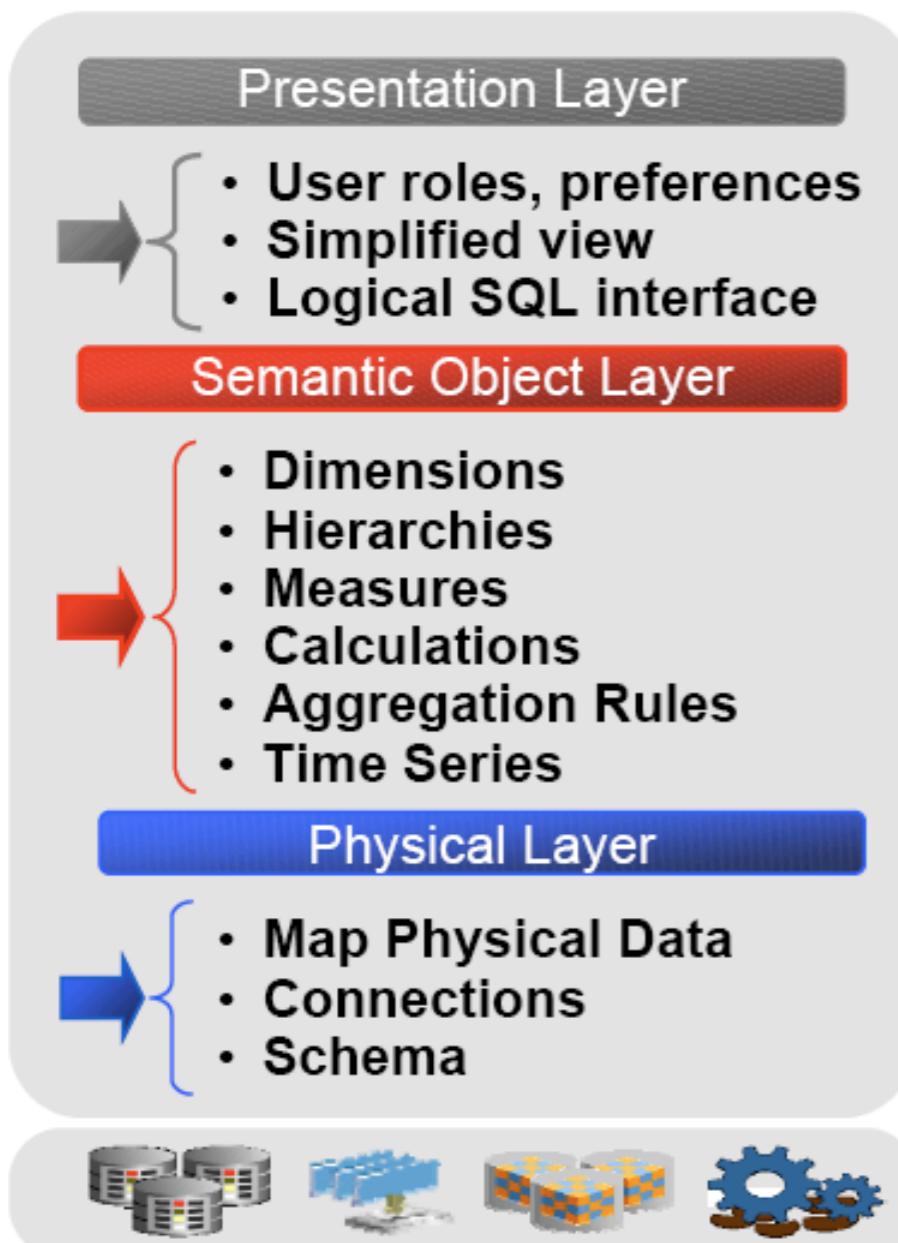
Oracle RDBMS  
Oracle OLAP Option  
Microsoft SQL Server &  
Analysis Services  
IBM DB2  
Teradata  
Essbase  
SAP BW  
XML, Excel, Text

### Data Integration



Oracle Data Integrator  
(Sunopsis)  
Oracle Warehouse Builder  
Informatica  
Ascential  
Others ..

# Common Enterprise Information Model



- Enables consistency, security, reuse, flexibility
- Role-based views of the organization
- Single metadata model of the business
- Consistent definition of business measures, metrics, calculations
- Drill paths, summaries, security
- Model once, deploy anywhere
- Across any data source

## Pervasive Information Access through a Unified BI Foundation



### Common Enterprise Information Model

Integrated Security, User Management, Personalization

Multidimensional Calculation and Integration Engine

Intelligent Request Generation and Optimized Data Access Services



OLTP & ODS  
Systems



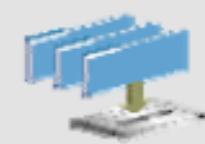
Data Warehouse  
Data Mart



Essbase



SAP, Oracle  
PeopleSoft, Siebel,  
Custom Apps

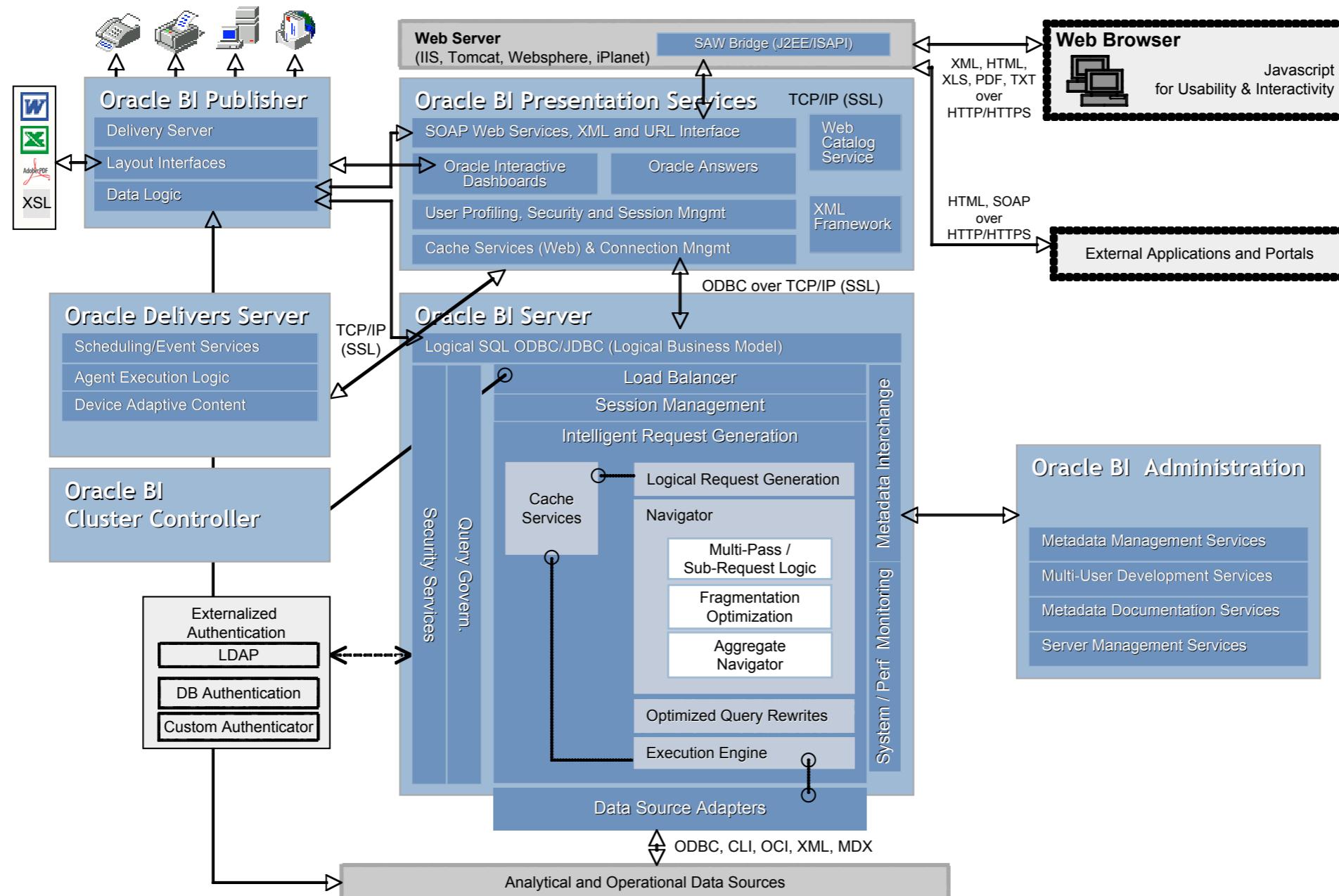


Files  
Excel  
XML



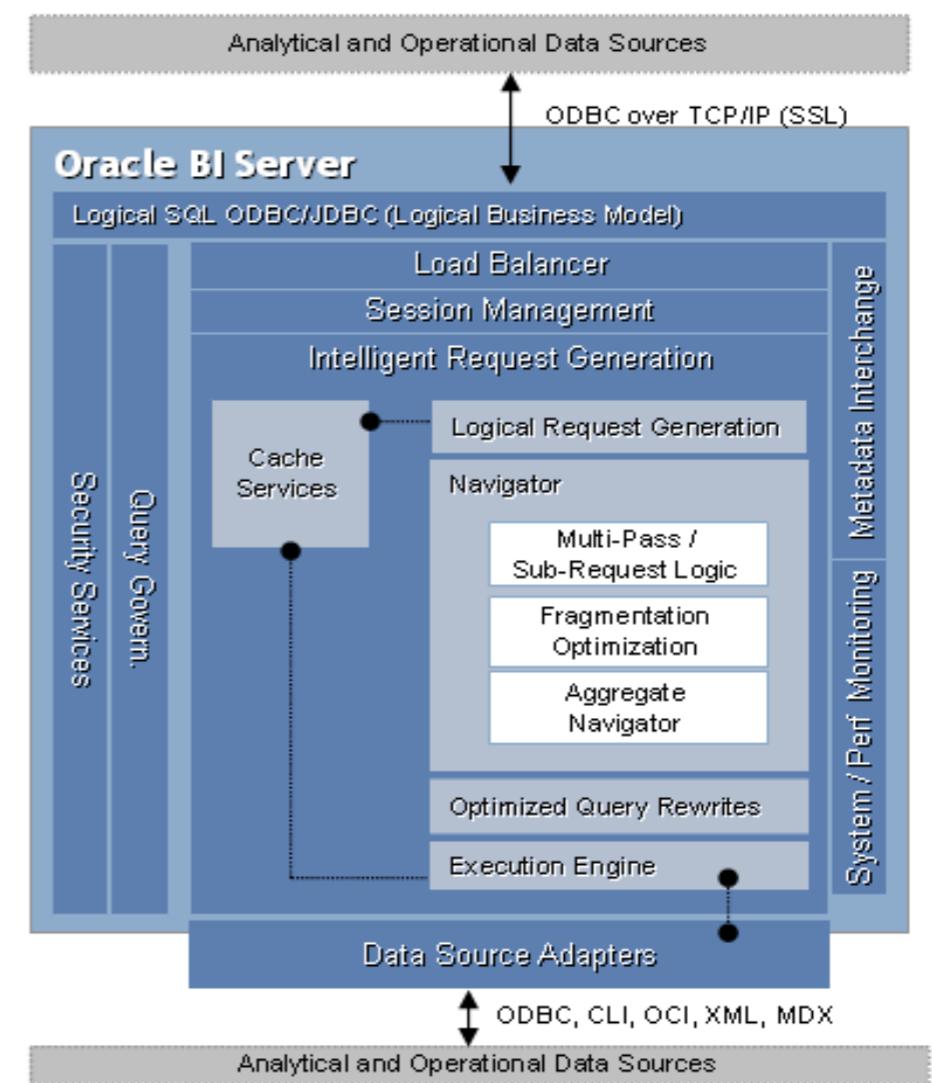
Business  
Process

# OBIEE 10gR3 Architecture



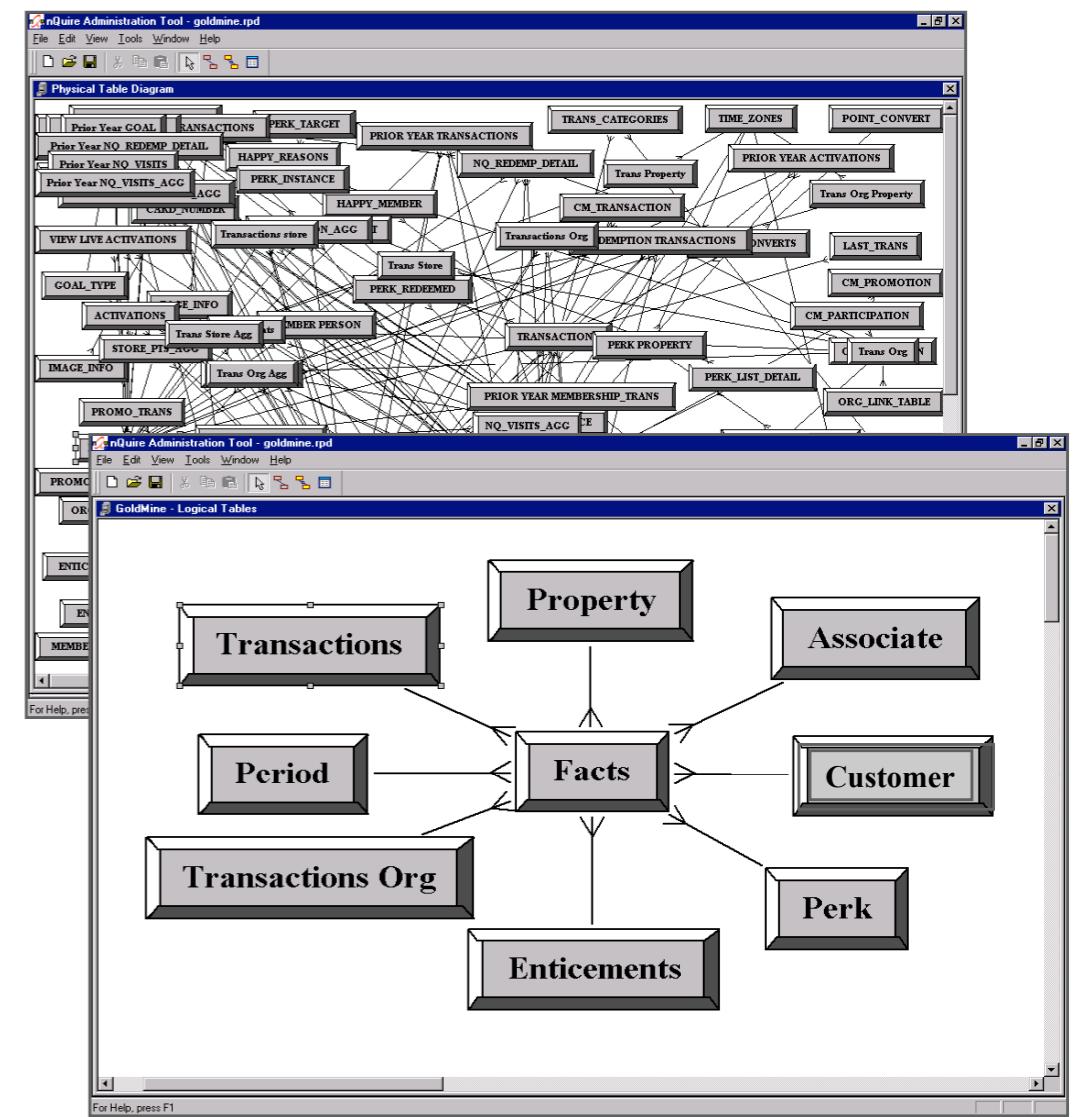
## Oracle BI Server

- Calculation and Data Integration Engine
  - ▶ “Virtual Data Warehouse”
  - ▶ Allows reporting across multiple sources
  - ▶ Data accessed through metadata layer
- Connects to RDBMS and OLAP data
  - ▶ Oracle Database (including Oracle OLAP)
  - ▶ IBM DB2
  - ▶ Microsoft SQL Server
  - ▶ Teradata
  - ▶ Microsoft Analysis Services (OLAP)
  - ▶ SAP BW 'info cubes'
- Security, Summary Management
- Translates incoming “logical SQL” in to optimized, physical SQL



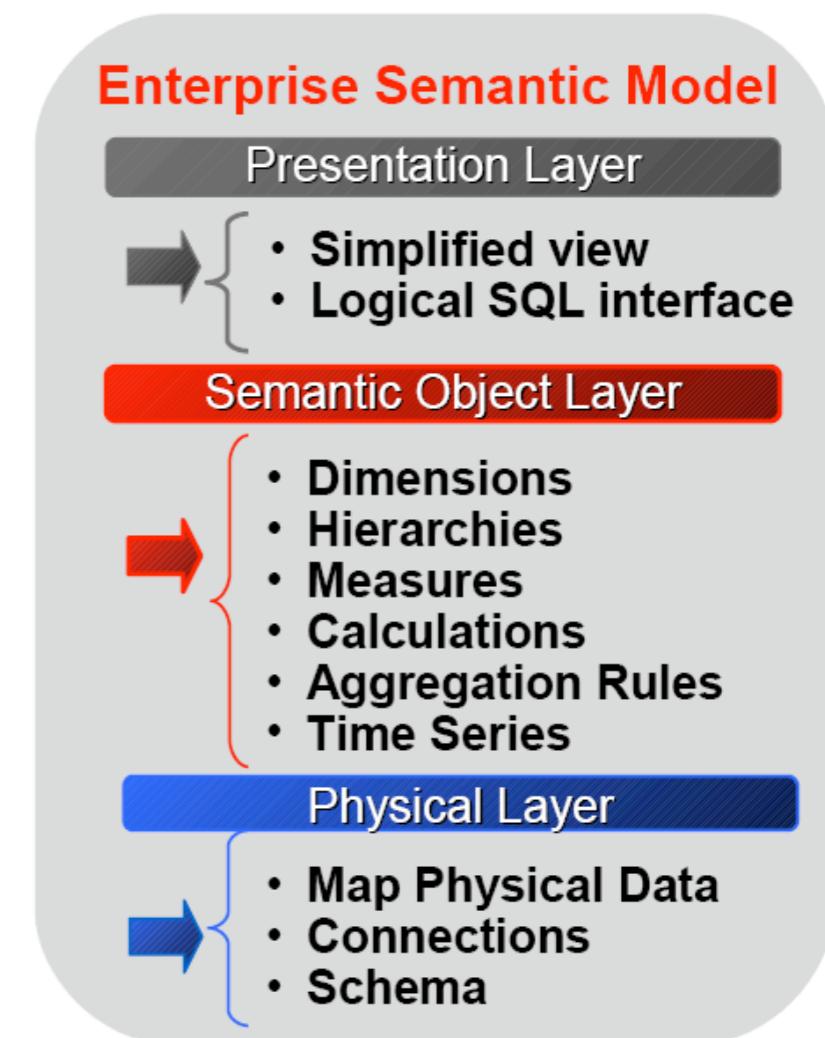
## OBIEE Federated Query Capability

- Reporting data may be sourced from multiple databases, applications
  - ▶ Oracle Database (including Oracle OLAP)
  - ▶ IBM DB2
  - ▶ Microsoft SQL Server
  - ▶ Teradata
  - ▶ Microsoft Analysis Services (OLAP)
  - ▶ SAP BW 'info cubes'
  - ▶ SAP, Peoplesoft, Siebel, E-Business Suite
- Oracle BI Server joins this source data together and presents a logical business model
  - ▶ Facts
  - ▶ Dimensions



## Information Model Layers

- Physical Layer contains connections, physical tables
  - ▶ Connections start as ODBC, switch to native (OCI etc)
  - ▶ Primary keys and foreign keys
- Logical layer is where the data is integrated
  - ▶ Logical fact tables, logical dimension tables
  - ▶ Dimensions
  - ▶ Calculations
  - ▶ Complex joins to define relationships
- Presentation layer is where data is presented
  - ▶ Can be a simple copy of the logical layer
  - ▶ Or can be made more personalized
  - ▶ Report centric



## Oracle Fusion Middleware

- Oracle data warehouses are increasingly built in the context of a “Service Orientated Architecture”
  - ▶ Data is available via messaging, provided by services
  - ▶ Oracle BI is part of Fusion Middleware, as is Essbase
- Data increasingly arrives in real-time and via non-traditional (db link) means



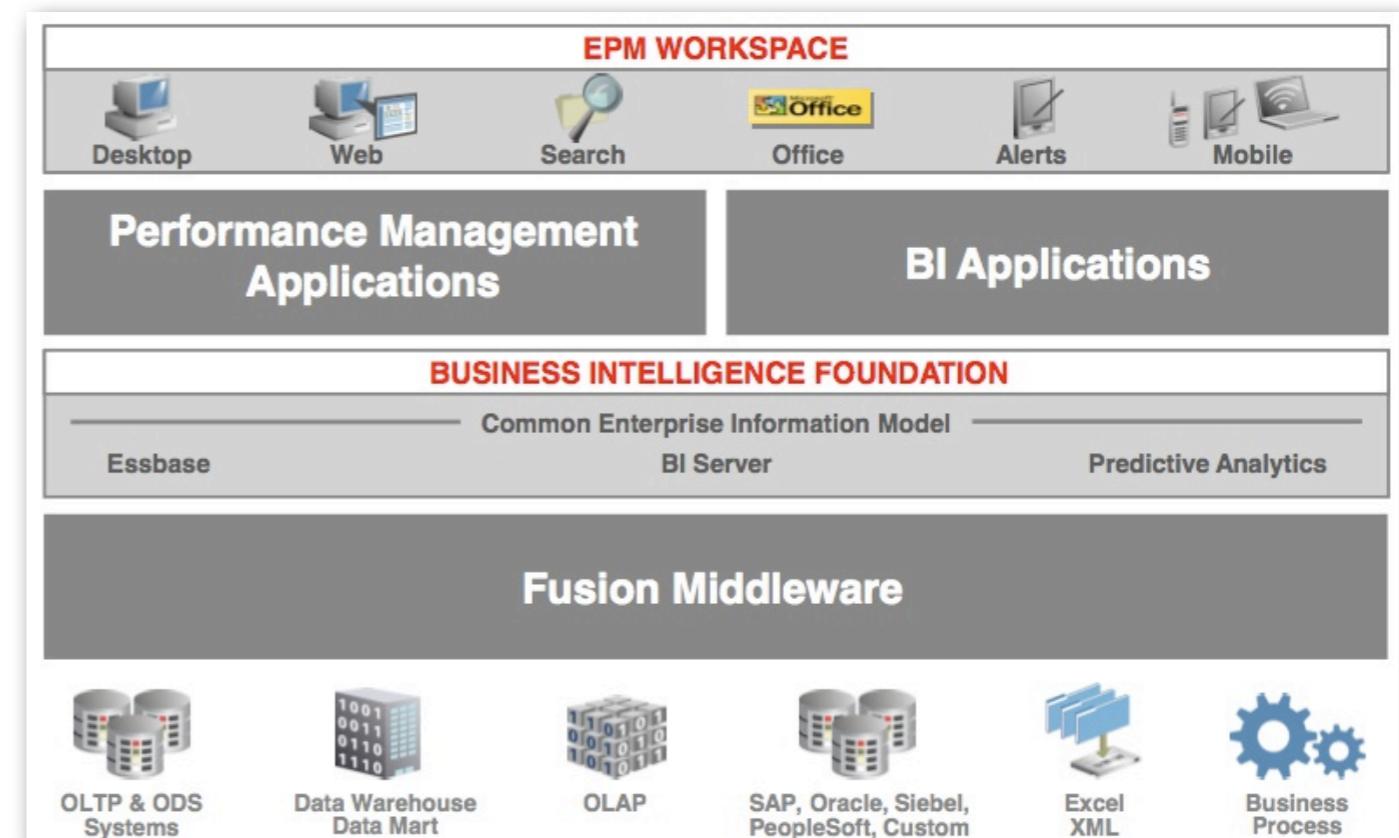
## Oracle EPM System, Fusion Edition 11.1.1

- The latest release of the ex-Hyperion toolset
- Essbase, Planning, Financial Management, Crystal Ball etc
- Planning and Financial Consolidation
- Multi-dimensional analysis
- Continuing Integration with OBIEE



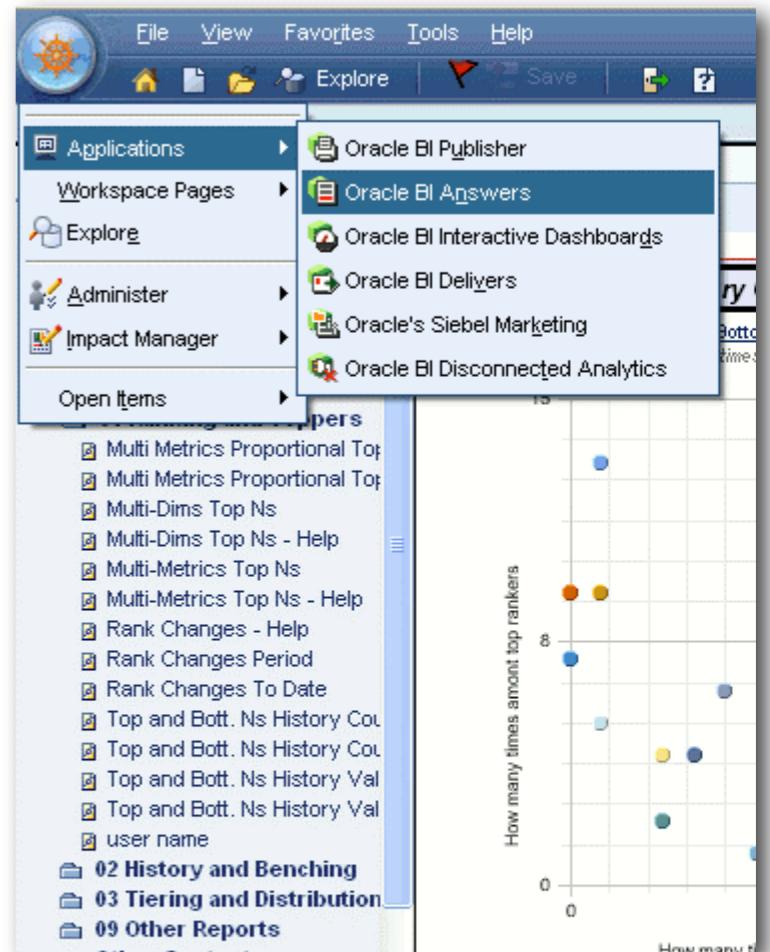
# Essbase and Oracle Business Intelligence Enterprise Edition

- Essbase is a key part of Oracle's Business Intelligence Foundation Layer
- Essbase and Hyperion EPM can play several roles in this architecture
  - ▶ As a data source
  - ▶ As a data consumer
  - ▶ As a portal for all Oracle BI
  - ▶ As a MS Office integration point
- Essbase can benefit from Oracle BI Enterprise Semantic Model
- OBIEE can benefit from Essbase calculations and analytics



## Integration of OBIEE Tools into EPM Workspace

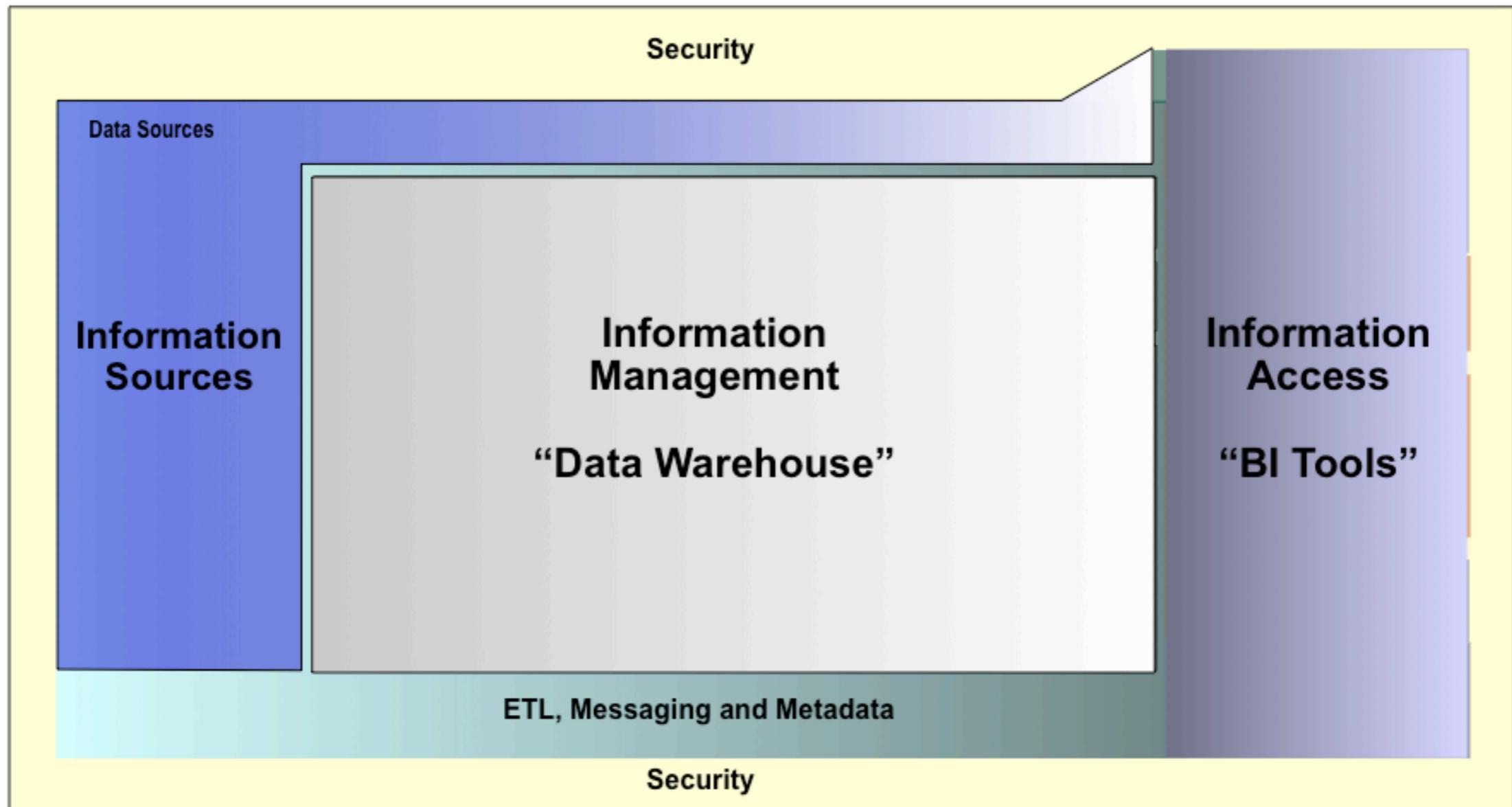
- From OBIEE 10.1.3.4 and Hyperion EPM 11.1, OBIEE tools can be embedded in Hyperion Workspace
- Access all tools through a common UI
  - ▶ Oracle BI Dashboards
  - ▶ Oracle BI Answers
  - ▶ Oracle BI Delivers
  - ▶ Oracle BI Publisher



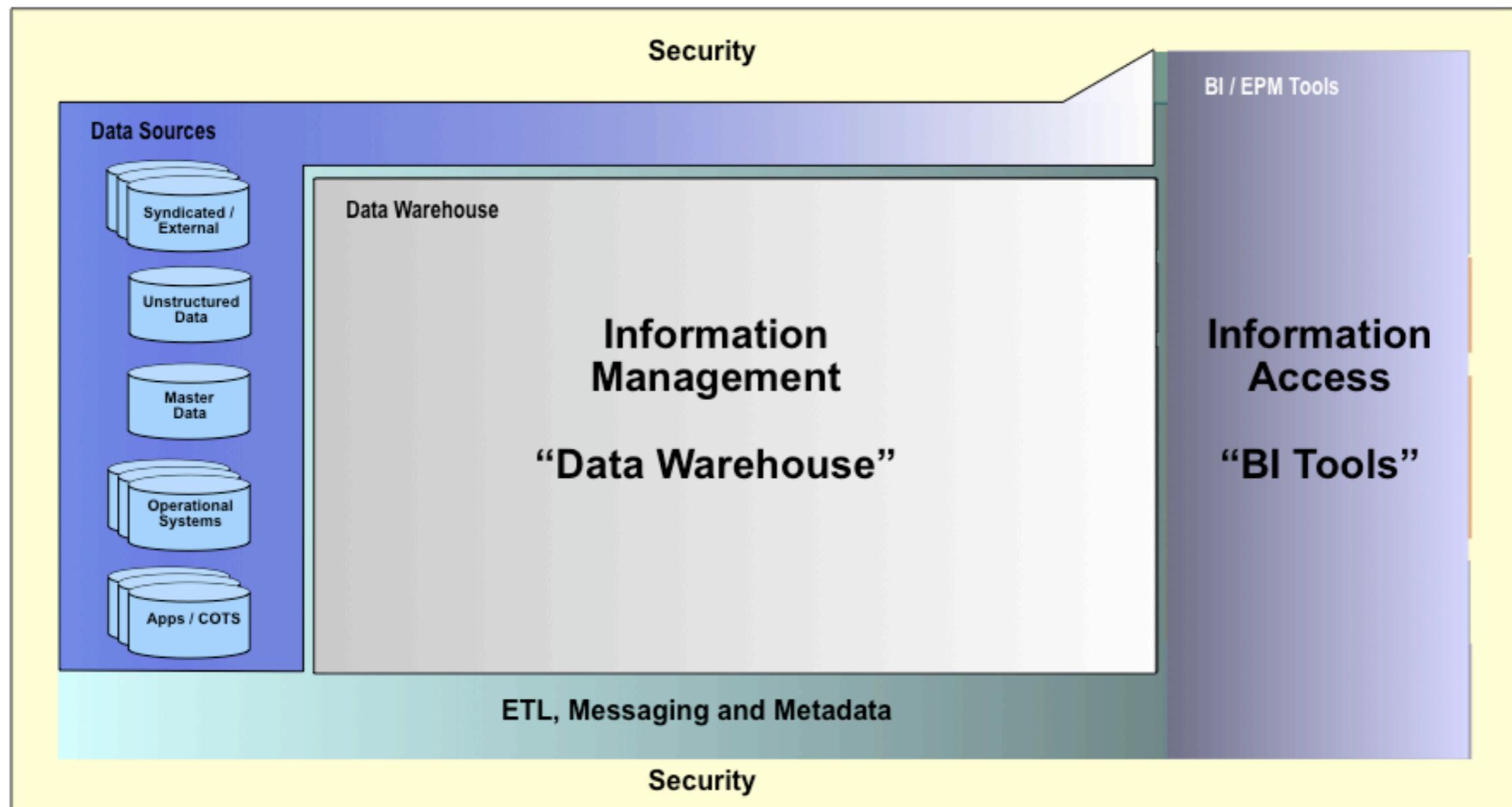
---

# So how does it all fit together?

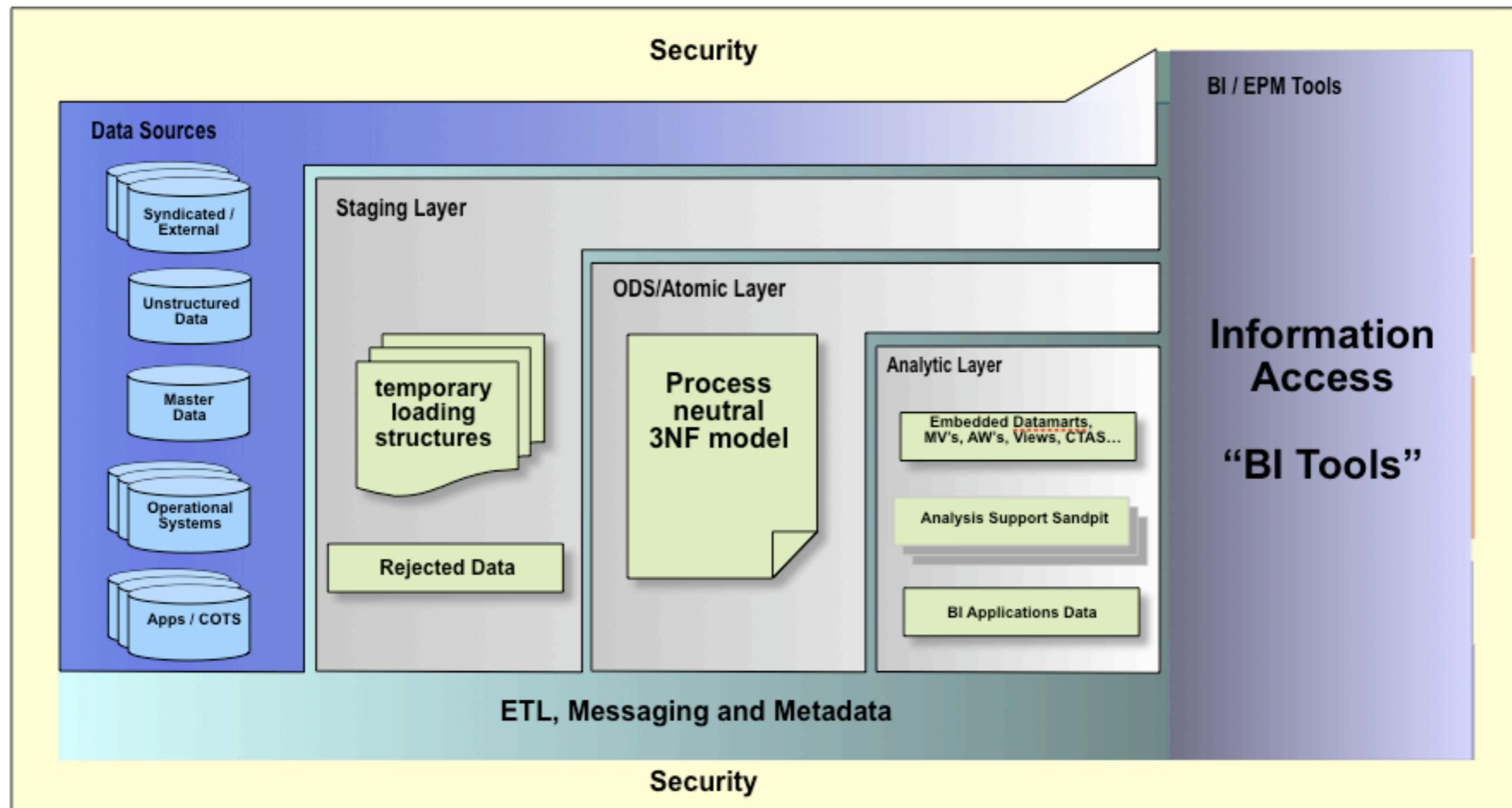
# A Future Oracle BI&DW Architecture



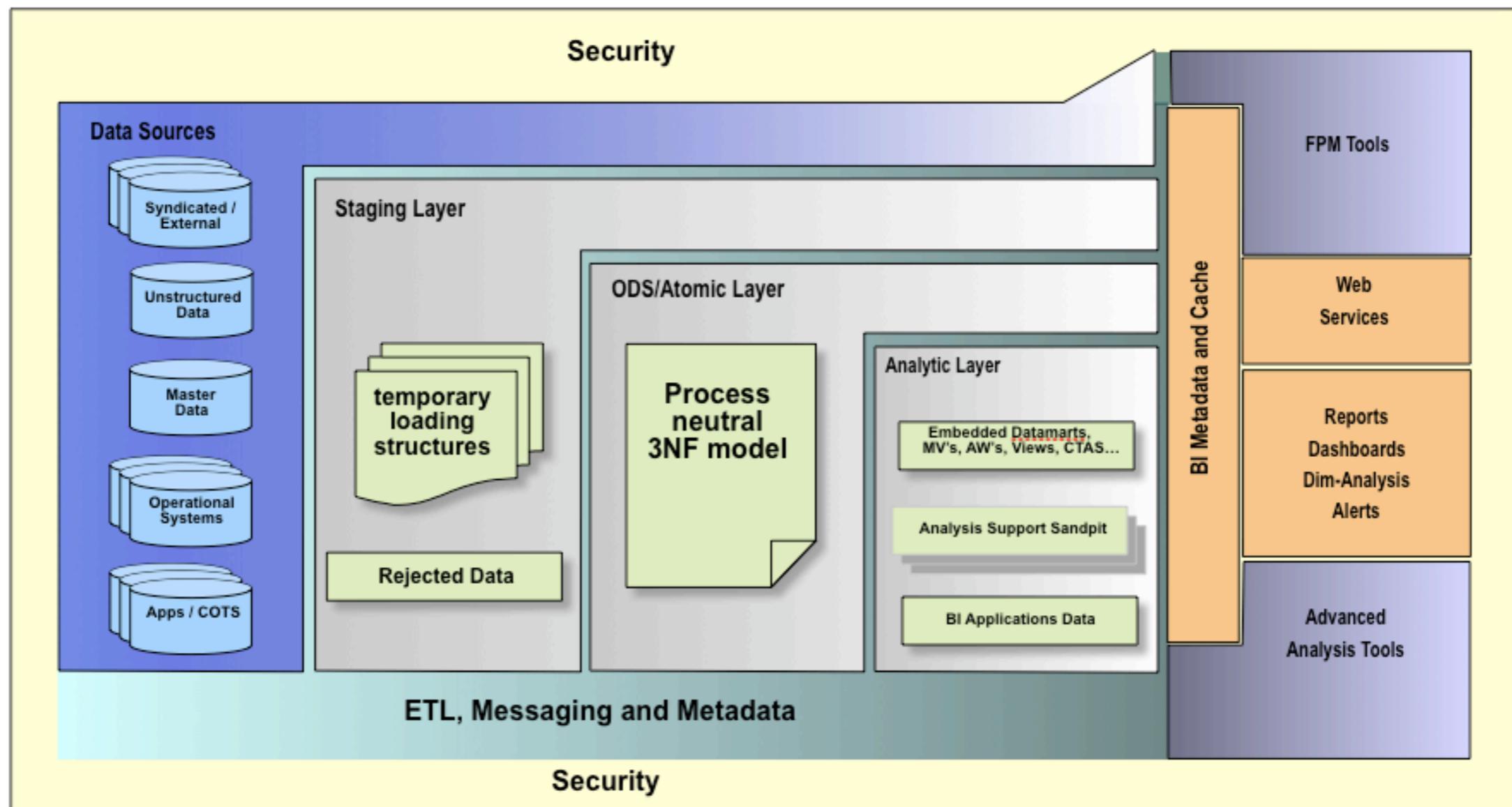
# A Future Oracle BI&DW Architecture



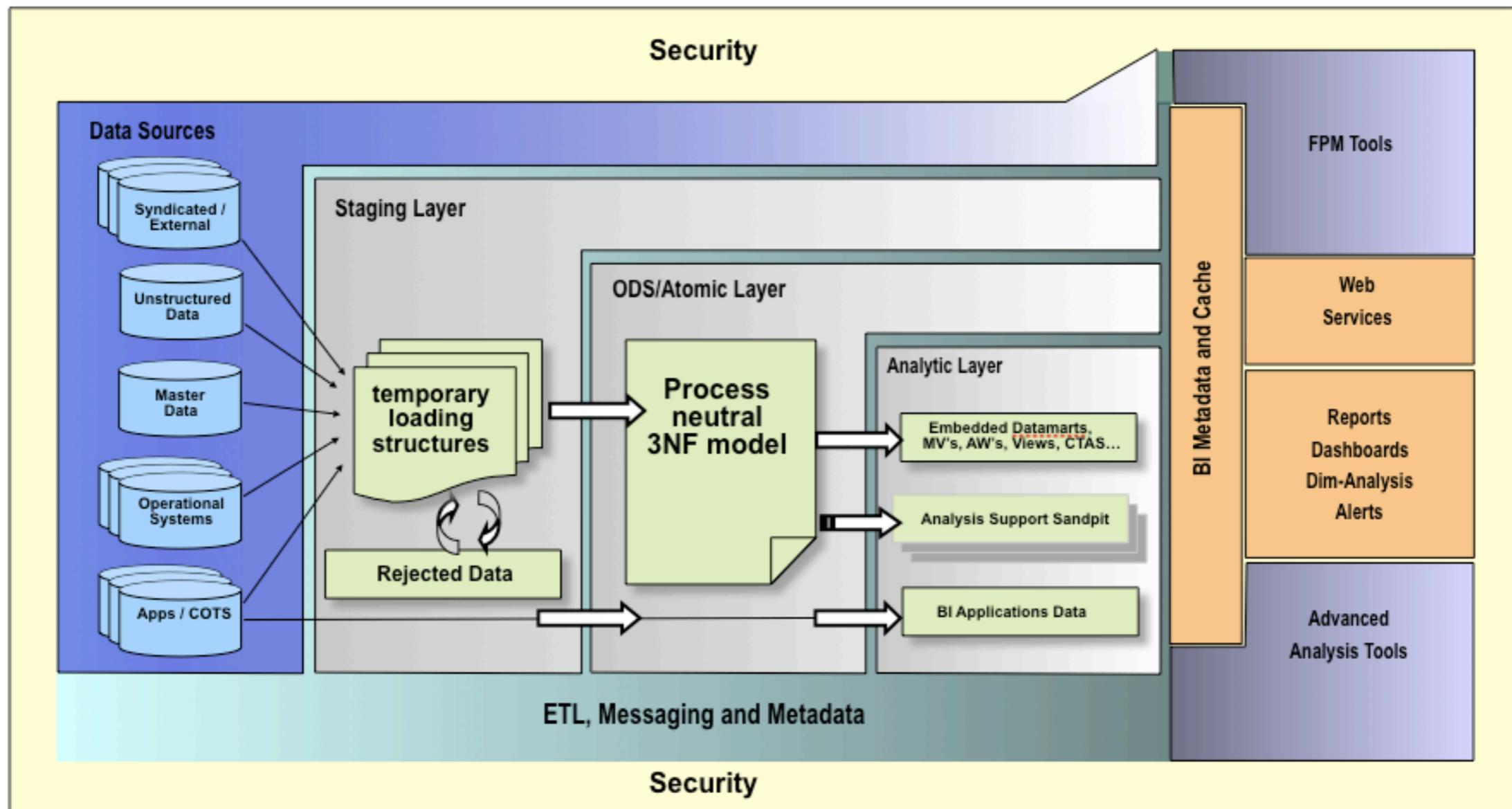
# A Future Oracle BI&DW Architecture



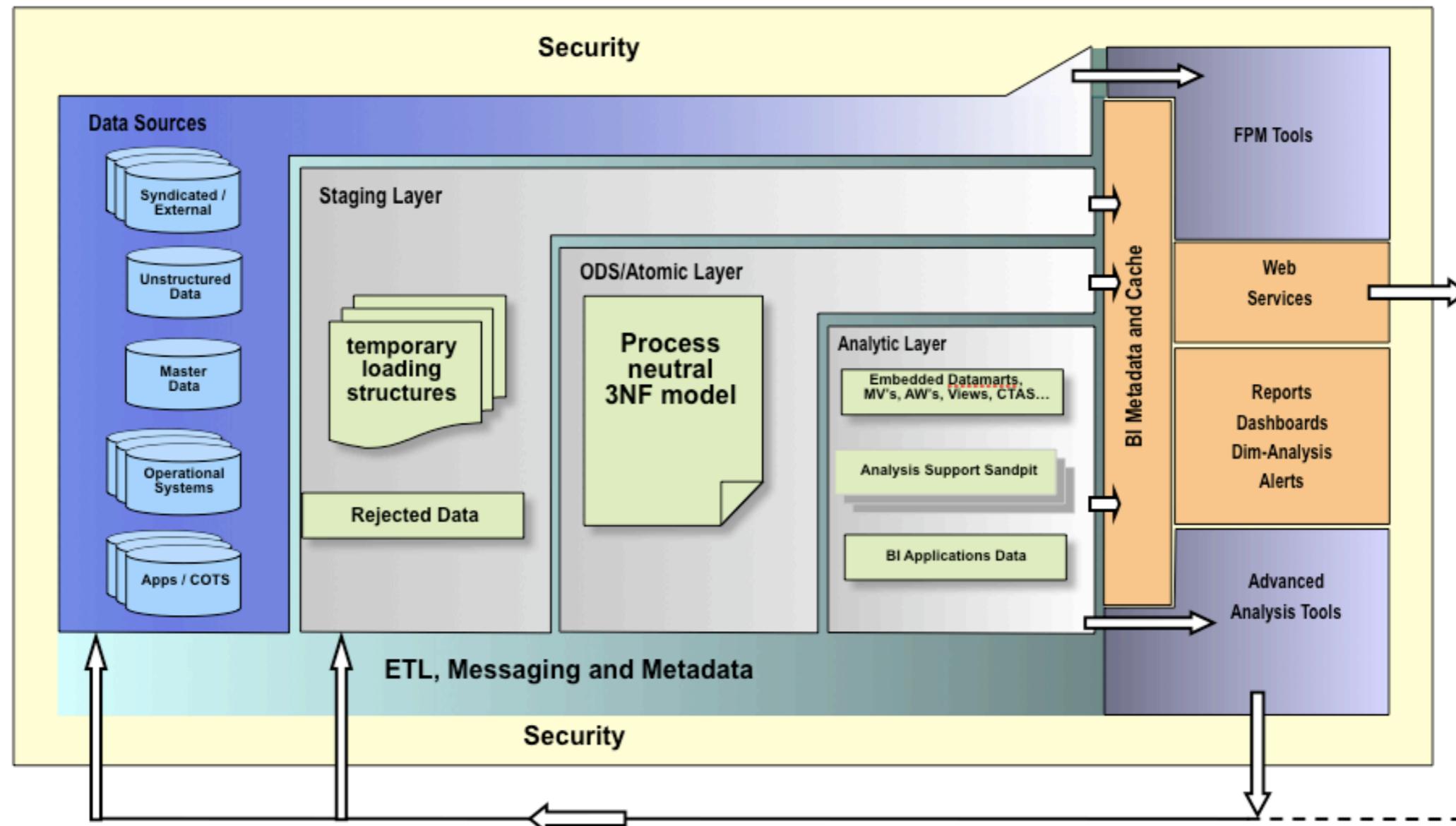
# A Future Oracle BI&DW Architecture



# A Future Oracle BI&DW Architecture

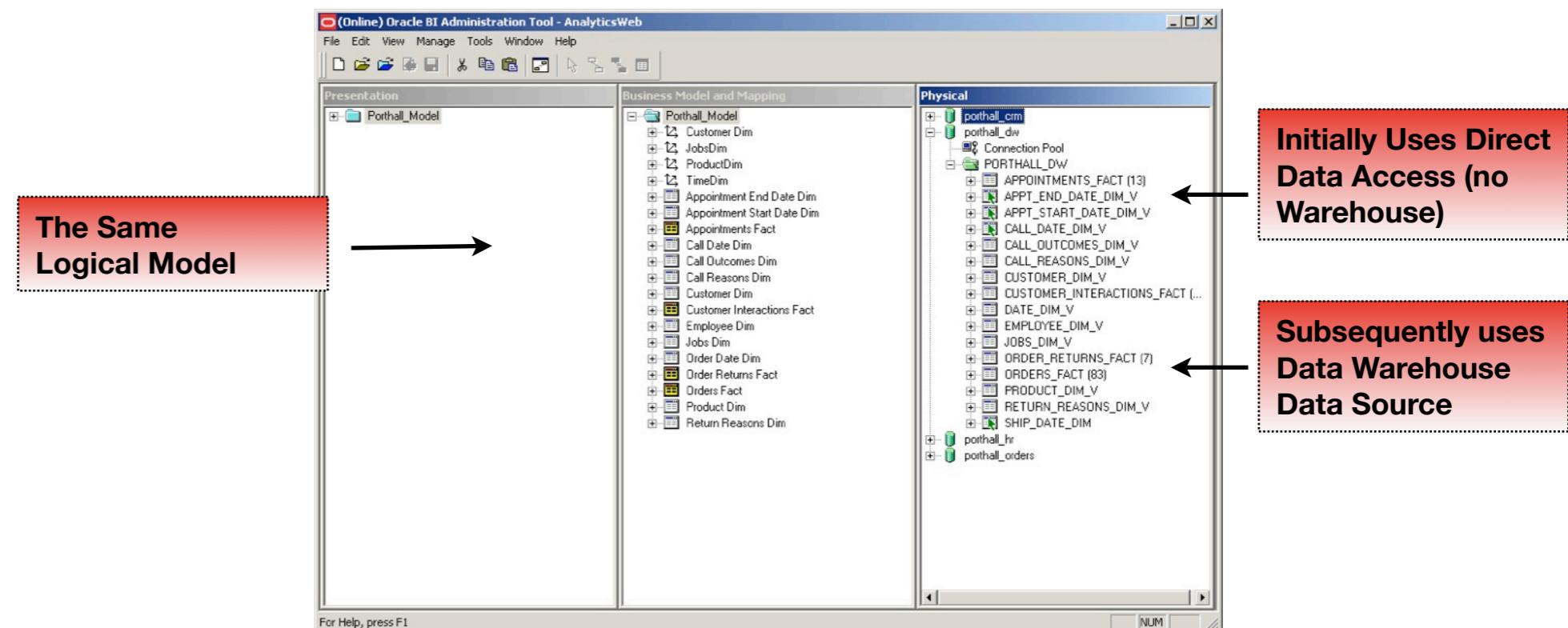


# A Future Oracle BI&DW Architecture



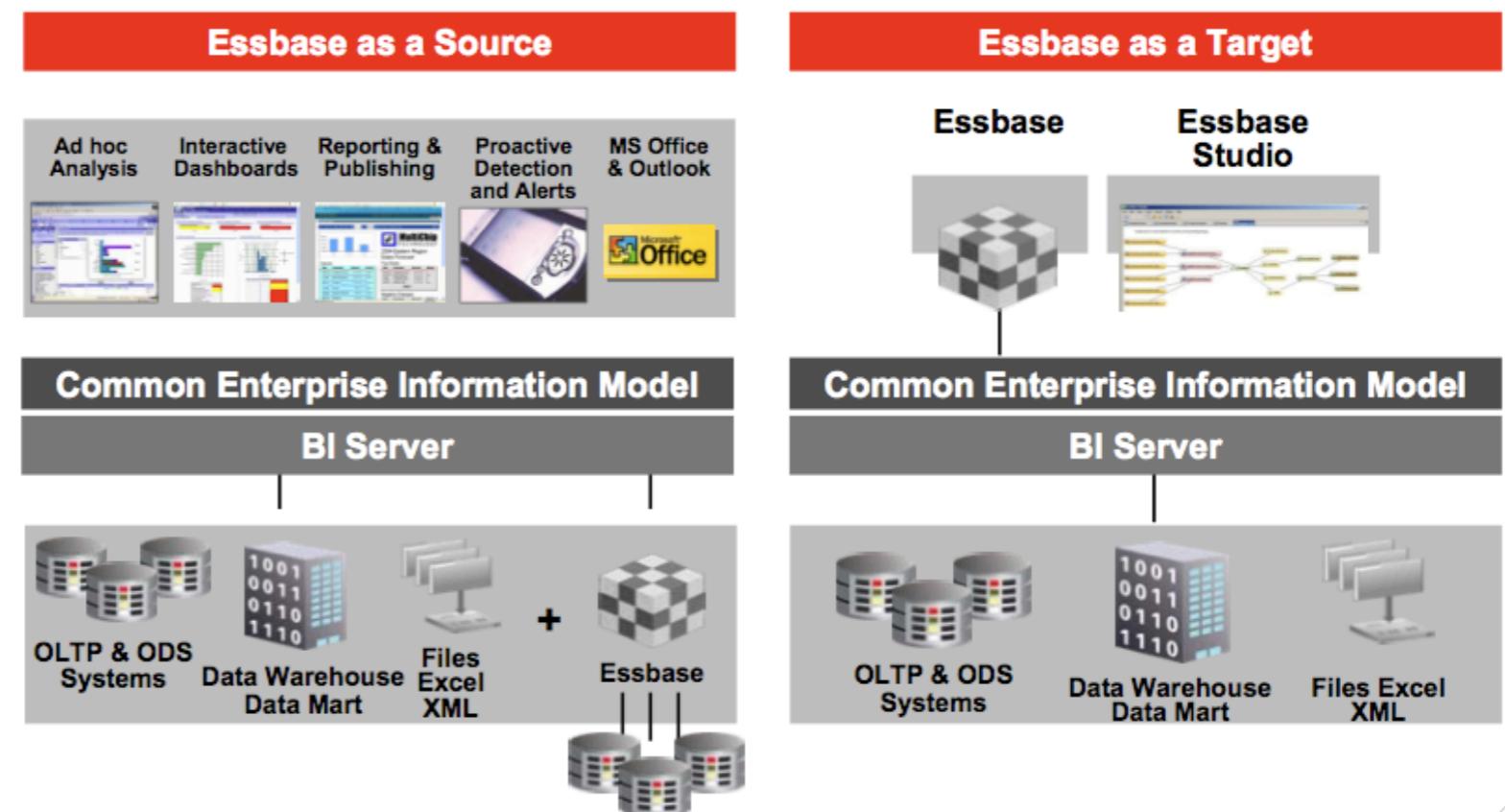
## Evolving Design Facilitated by the Abstracted OBIEE Info Model

- This next-generation DW architecture is facilitated by two key OBIEE features
  - ▶ Federated query, can source data from DW and multiple other sources
  - ▶ Presents data to users as a single logical model
  - ▶ Logical model's physical data mapping can evolve over time, preserving reports

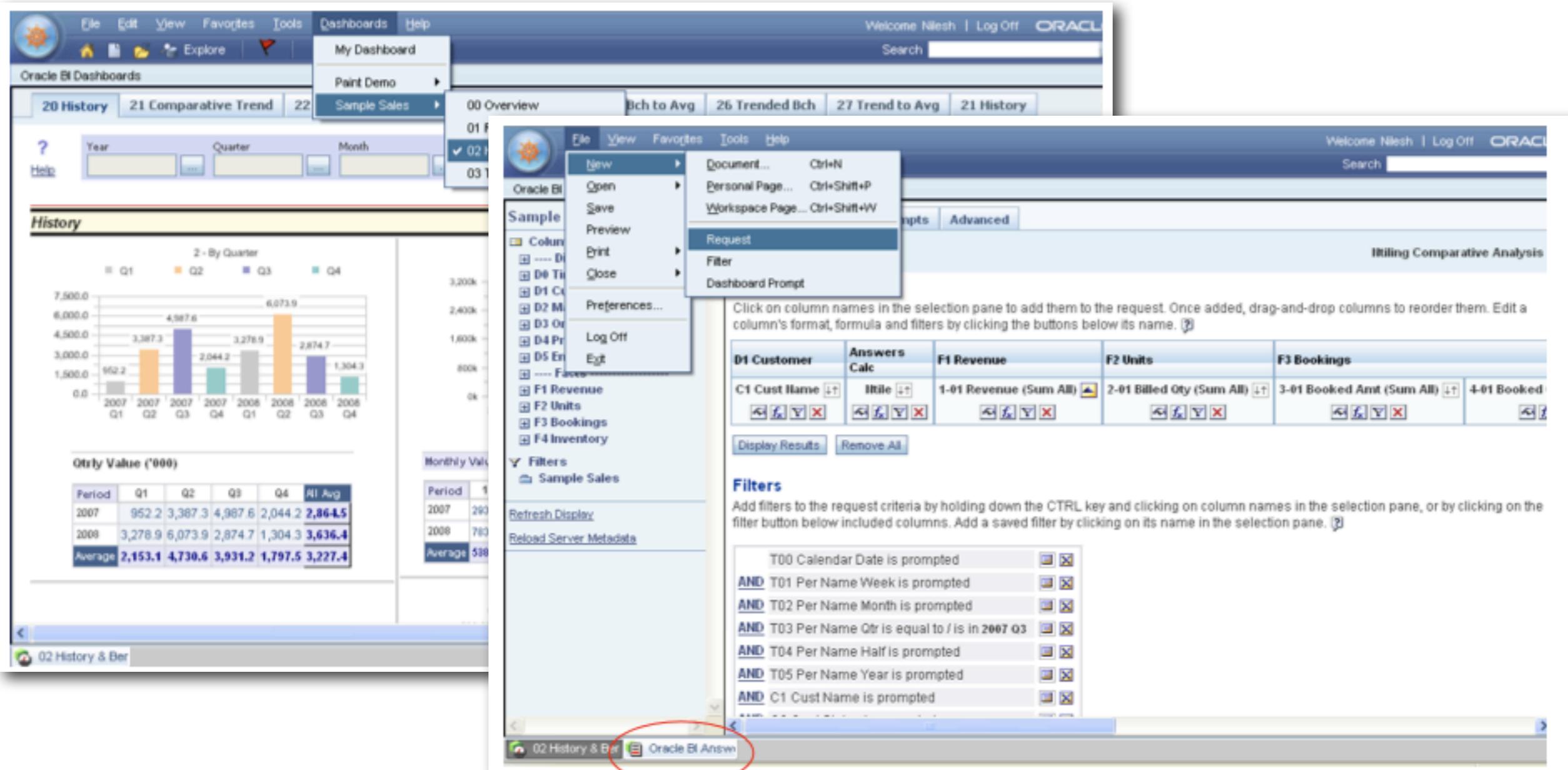


## EPM Data Sourced From the Common Enterprise Information Model

- Performance Management tools can source their data from the Common Enterprise Information Model (single source of data)
- EPM data can then be added to the Common Enterprise Information Model to complete the planning and forecasting loop



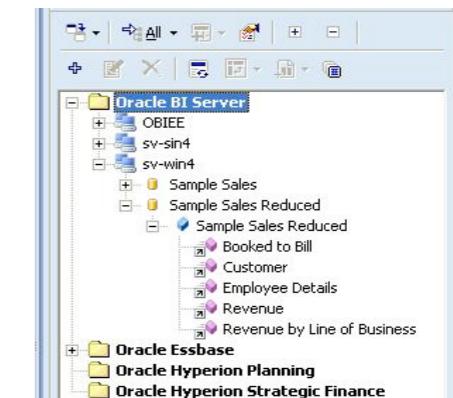
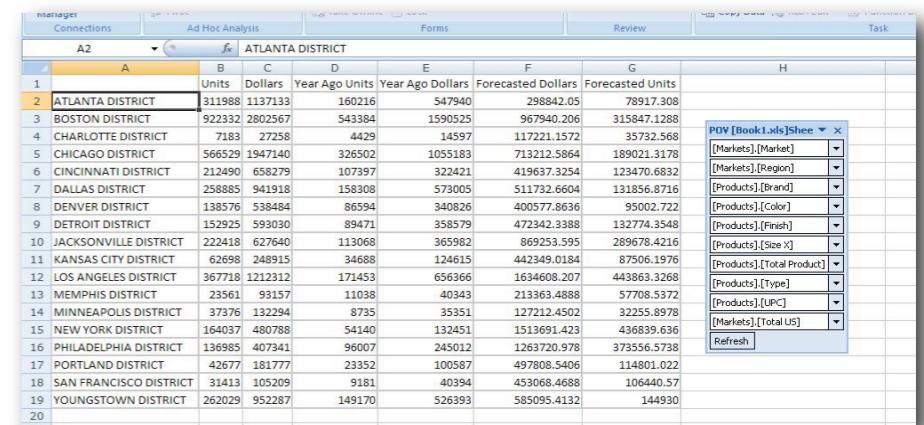
# Single Unified EPM Workspace



The screenshot illustrates the Oracle BI environment, specifically the Single Unified EPM Workspace. It shows a dashboard titled "My Dashboard" with a "Sample Sales" report selected. The report displays a bar chart titled "2 - By Quarter" comparing sales across four quarters (Q1, Q2, Q3, Q4) for two years (2007 and 2008). Below the chart is a table showing monthly values ('000) and averages. A context menu is open over the chart, showing options like "New", "Open", "Save", "Preview", "Print", "Close", "Request", "Filter", and "Dashboard Prompt". Another context menu is open over the "File" menu, listing "Document...", "Open", "Save", "Personal Page...", "Workspace Page...", "Log Off", and "Exit". The "Request" menu item is highlighted. To the right of the dashboard, there is a "Request" editor window. This window contains a table with columns labeled D1 Customer, Answers Calc, F1 Revenue, F2 Units, and F3 Bookings. It includes a "Display Results" button and a "Remove All" button. Below the table is a "Filters" section with a list of prompts: T00 Calendar Date is prompted, AND T01 Per Name Week is prompted, AND T02 Per Name Month is prompted, AND T03 Per Name Qtr is equal to / is in 2007 Q3, AND T04 Per Name Half is prompted, AND T05 Per Name Year is prompted, AND C1 Cust Name is prompted. At the bottom of the Request editor, there is a red circle highlighting the "Oracle BI Answer" tab.

## Single Unified EPM Integration with Microsoft Office

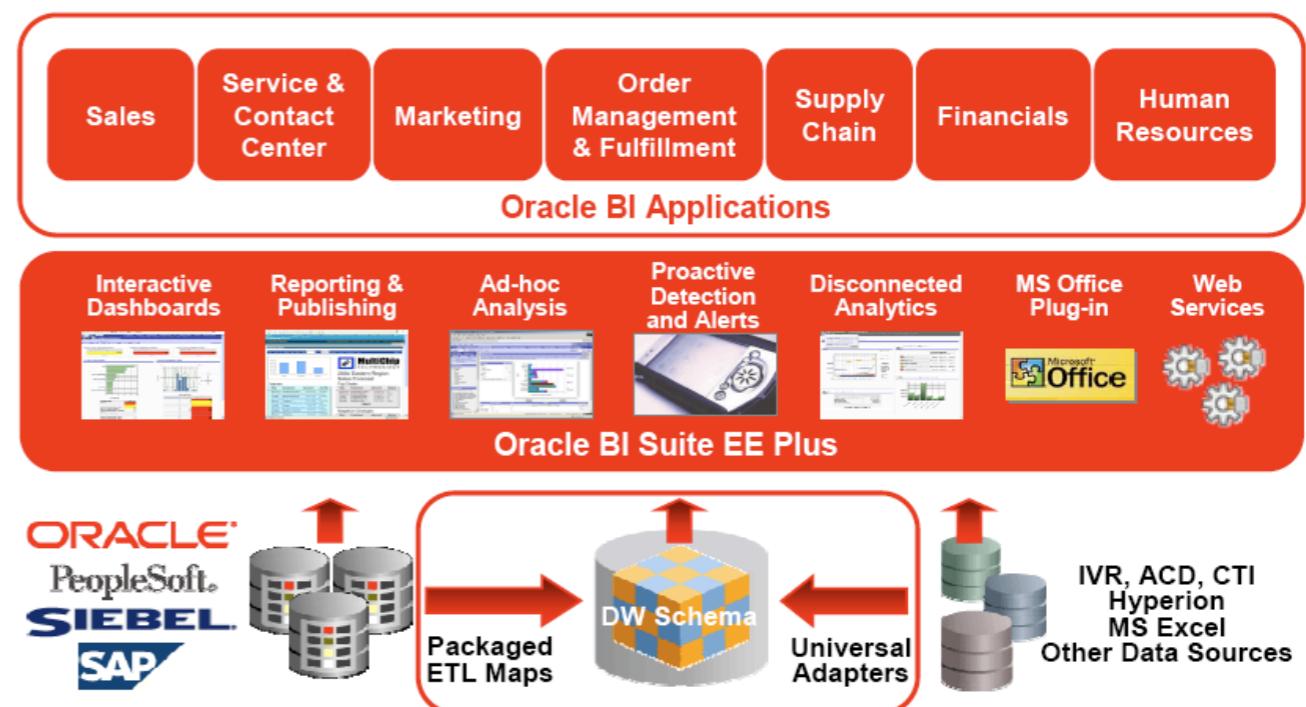
- Smart View and Smart Space 11.1 support OBIEE from releases 10.1.3.3.1 +
- Works through Provider Services, but Provider Services / Essbase license not required for use
- OBIEE added as a data source, connects via JDBC
- OBIEE content can be viewed within Smart Space gadgets
  - ▶ Oracle BI Answers
  - ▶ Oracle BI Publisher
  - ▶ Oracle BI Delivers
  - ▶ Oracle BI Dashboards

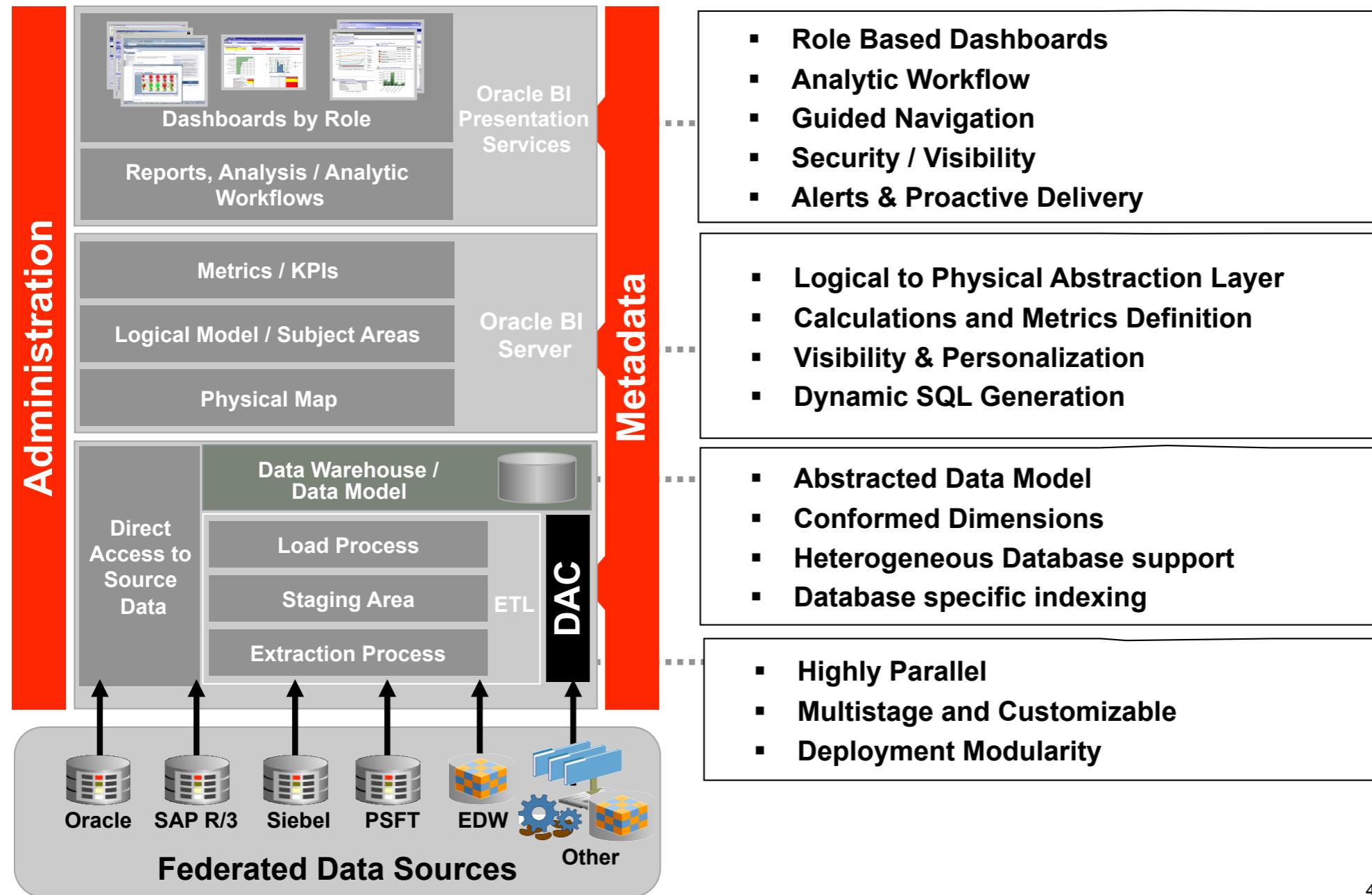
	A	B	C	D	E	F	G	H
	A2							
1		Units	Dollars	Year Ago Units	Year Ago Dollars	Forecasted Dollars	Forecasted Units	
2	ATLANTA DISTRICT	311988	1137133	160216	547940	298842.05	78917.308	
3	BOSTON DISTRICT	922332	2802567	543384	1590525	967940.206	315847.1288	
4	CHARLOTTE DISTRICT	7183	27258	4429	14597	117221.1572	35732.568	
5	CHICAGO DISTRICT	566529	1947140	326502	1055183	713212.5864	189021.3178	
6	CINCINNATI DISTRICT	212490	658279	107397	322421	419637.3254	123470.6832	
7	DALLAS DISTRICT	258885	941918	158308	573005	511732.6604	131856.8716	
8	DENVER DISTRICT	138576	538484	86594	340826	400577.8636	95002.722	
9	DETROIT DISTRICT	152925	593030	89471	358579	472342.3388	132774.3548	
10	JACKSONVILLE DISTRICT	222418	627640	113068	365982	869253.595	289678.4216	
11	KANSAS CITY DISTRICT	62698	248915	34688	124615	442349.0184	87506.1976	
12	LOS ANGELES DISTRICT	367718	1212312	171453	656366	1634608.207	443863.3268	
13	MEMPHIS DISTRICT	23561	93157	11038	40343	213363.4888	57708.5372	
14	MINNEAPOLIS DISTRICT	37376	132294	8735	35351	127212.4502	32255.8978	
15	NEW YORK DISTRICT	164037	480788	54140	132451	1513691.423	436839.636	
16	PHILADELPHIA DISTRICT	136985	407341	96007	245012	1263720.978	373556.5738	
17	PORTLAND DISTRICT	42677	181777	23352	100587	497808.5406	114801.022	
18	SAN FRANCISCO DISTRICT	31413	105209	9181	40394	453068.4688	106440.57	
19	YOUNGSTOWN DISTRICT	262029	952287	149170	526393	585095.4132	144930	
20								

## Build vs. Buy #1: Oracle Business Analytics Warehouse

- An alternative to building your own data warehouse, is to buy Oracle's "Oracle Business Analytics Warehouse", part of Oracle BI Applications
- Conformed, dimensional data warehouse designed for use with OBIEE
- Predefined extract routines from EBS, PSFT, SAP, Siebel CRM
- Predefined OBIEE dashboards, reports, alerts
- Licensed by analysis area

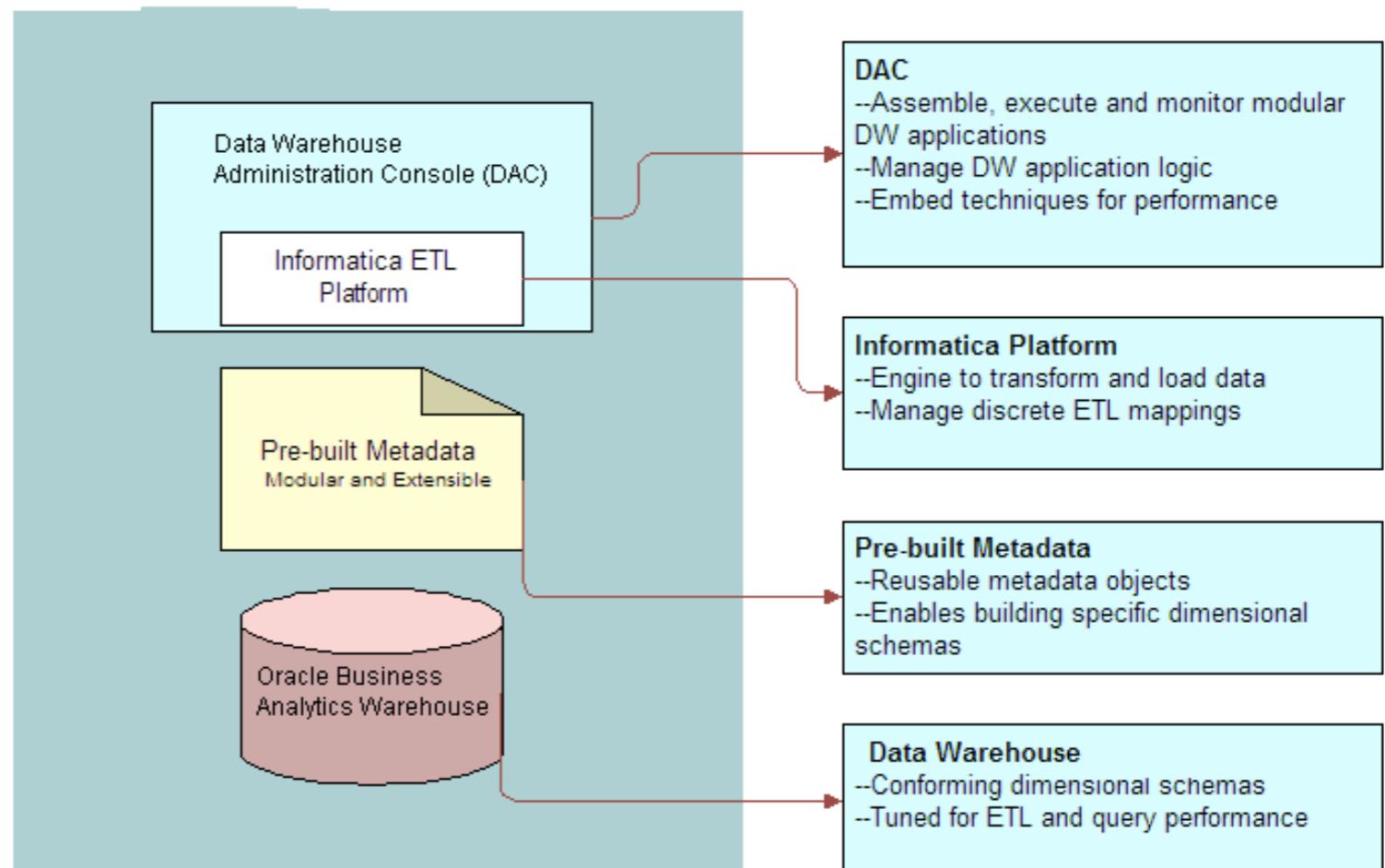


# Oracle BI Applications Architecture



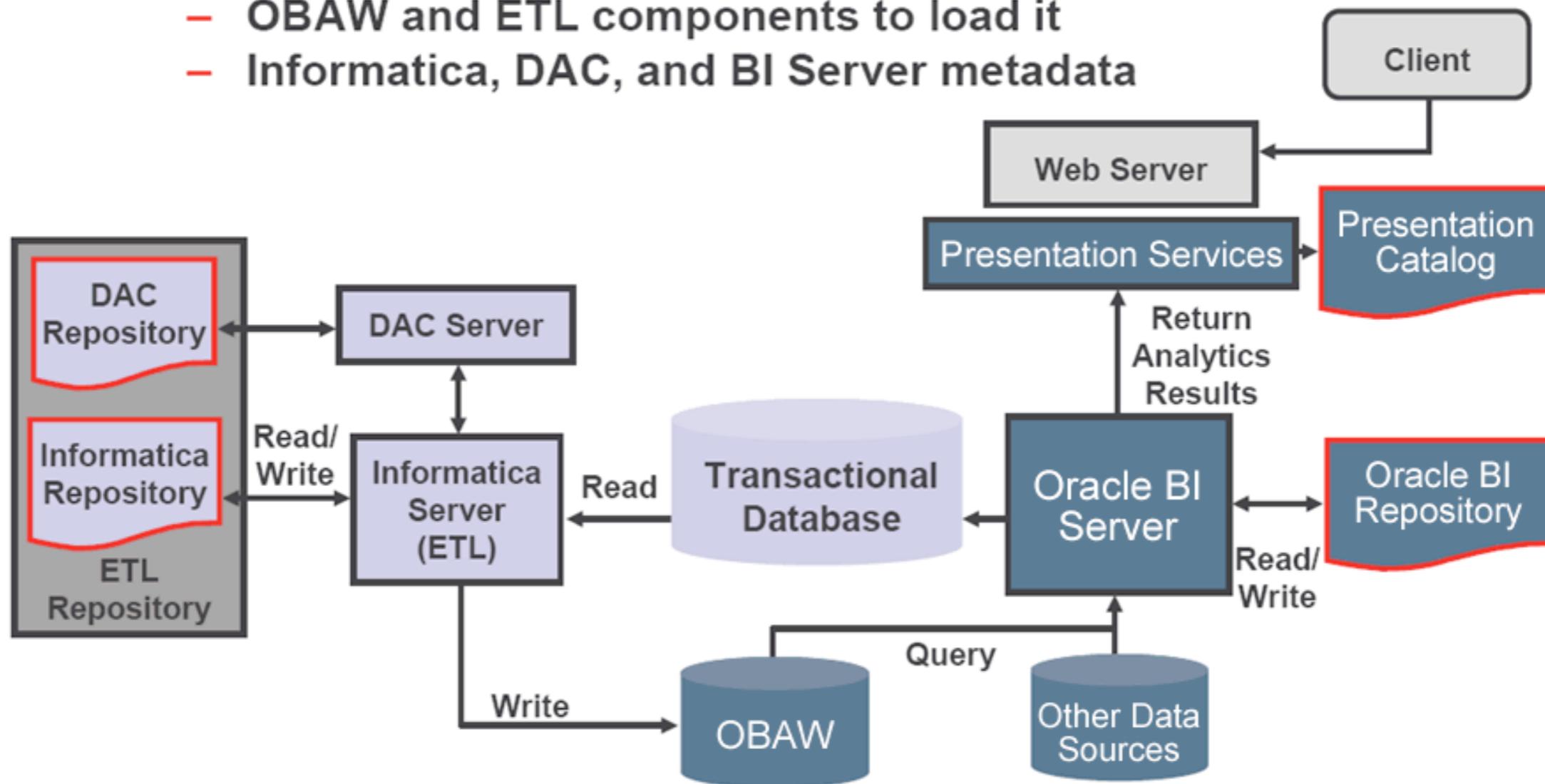
# Oracle BI Applications Data Architecture

- Oracle Business Analytics Warehouse (OBAW) holds reporting data extracted from ERP, CRM etc systems
- OBIEE Repository holds reporting metadata
- Data Warehouse Administration Console (DAC) executes Informatica mappings to load data into the OBAW
  - ▶ Informatica is the embedded ETL tool
  - ▶ In future, same functionality will be provided via Oracle Data Integrator (ODI)



# Oracle BI Applications Product Architecture

- Includes infrastructure components and:
    - OBAW and ETL components to load it
    - Informatica, DAC, and BI Server metadata



# Oracle Data Warehouse Administration Console

- Control panel for running the OBAW load process
- ETL packaged into Execution Plans
- Tight integration with Informatica
- Run jobs, monitor progress
- The added value on top of the OBAW and INFA mappings

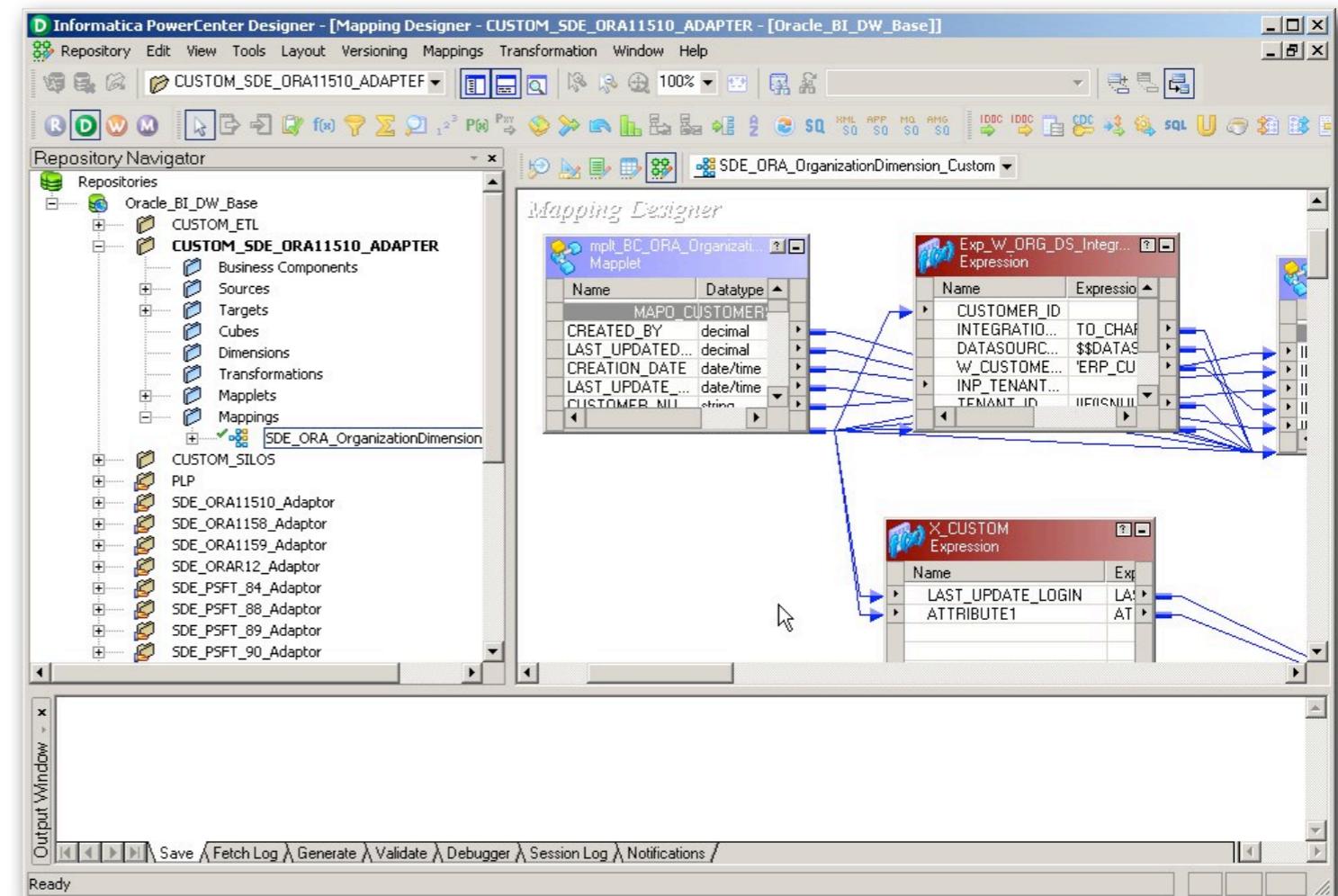
Tasks				Configuration Tags		Source System Parameters		Source System Folders			
				Subject Areas		Tables		Indices			
				New	Reference	Save	Undo	Delete	Query	Refresh	All
				Name	Parent Group	Command for Incremental Load		Command for Full Load			
				Custom_ETL		w_LabWLoadCustomerLocD		w_LabWLoadCustomerLocD			
				DL_Extract ETL metadata		SDE_DL_infa		SDE_DL_infa			
				DL Extract OLTP metadata for ora ...		SDE_DL_ora_ebs		SDE_DL_ora_ebs			
				DL Extract RPD metadata		SDE_DL_rpd		SDE_DL_rpd			
				DL Extract Webcat metadata		SDE_DL_webcat		SDE_DL_webcat			
				DL Load into ETL Fact		SIL_DL_ETL_Fact_Incremental		SIL_DL_ETL_Fact_Full			
				DL Load into ETL Hierarchy		SIL_DL_ETL_Hierarchy		SIL_DL_ETL_Hierarchy			
				DL Load into Oracle OLTP Fact		SIL_DL_Oracle_EBS_Fact_Incremental		SIL_DL_Oracle_EBS_Fact_Full			
				DL Load into RPD Fact		SIL_DL_OBI_RPD_Fact_Incremental		SIL_DL_OBI_RPD_Fact_Full			

Target Tables		Conditional Tables		Phase Dependency		Configuration Tags		Parameters		Source Tables	
Edit				Description							
* Name:				Command for Incremental Load:		Command for Full Load:					
Custom_ETL				w_LabWLoadCustomerLocD		w_LabWLoadCustomerLocD					
Folder Name:		CUSTOM_ETL_OM		Primary Source:		DBConnection_OLTP		Primary Target:		DBConnection_OLAP	
* Task Phase:		Extract Dimension		* Execution Type:		Informatica		* Priority:		5	
Pre-SQL for Full Load:				Pre-SQL for Incremental Load:				Post-SQL for Full Load:			

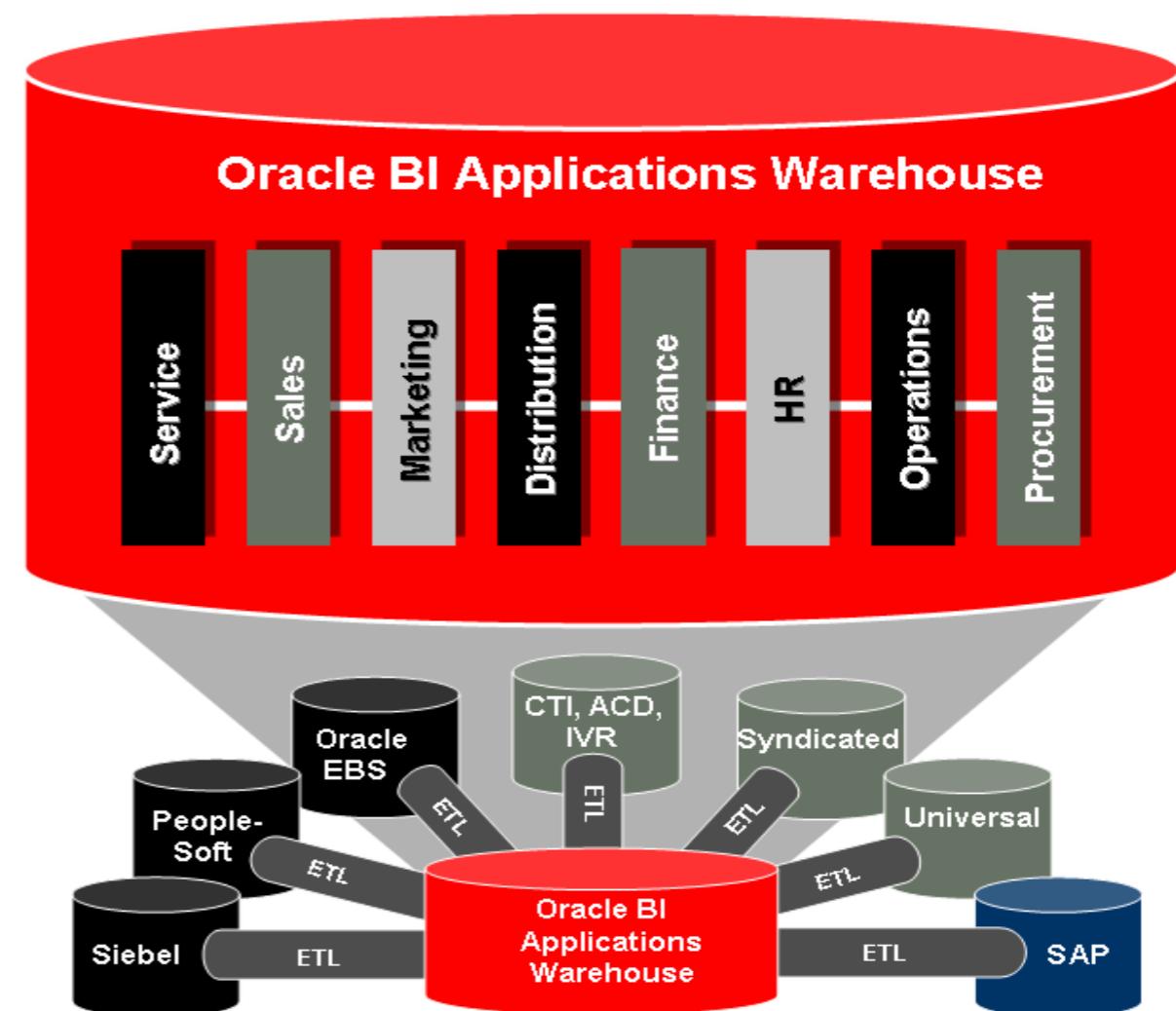
## Informatica PowerCenter 8.1.1

- The Informatica ETL tool is used to load data into the OBAW
  - ▶ Support for multiple platforms, initial work done by INFA to load warehouse
- Similar development style to OWB, ODI
- Licensed for loading the OBAW only
- Mappings sequenced and controlled from DAC
  - ▶ Positioned as an embedded tool



## Predefined, Integrated Dimensional Data Warehouse

- Integrated, conformed dimensional data warehouse
- Allows modular deployment
- Lowest grain of information
- Prebuilt aggregates
- Deployable on Oracle, MS SQL, IBM DB/2 and Teradata
- History tracking
- Indexing



# OBAW Table Contents and Categories

- There are several categories of table within the OBAW
- Easy to determine purpose of table due to Oracle's naming standards
- \_F fact tables
- \_D dimension tables
- \_FS fact staging tables
- \_DS dimension staging
- \_A aggregate tables
- other tables to support the ETL process, queries

<b>Sales</b>	<ul style="list-style-type: none"> <li>▪ Opportunities</li> <li>▪ Quotes</li> <li>▪ Pipeline</li> </ul>
<b>Order Management</b>	<ul style="list-style-type: none"> <li>▪ Sales Order Lines</li> <li>▪ Sales Schedule Lines</li> <li>▪ Bookings</li> <li>▪ Pick Lines</li> <li>▪ Billings</li> <li>▪ Backlogs</li> </ul>
<b>Marketing</b>	<ul style="list-style-type: none"> <li>▪ Campaigns</li> <li>▪ Responses</li> <li>▪ Marketing Costs</li> </ul>
<b>Supply Chain</b>	<ul style="list-style-type: none"> <li>▪ Purchase Order Lines</li> <li>▪ Purchase Requisition Lines</li> <li>▪ Purchase Order Receipts</li> <li>▪ Inventory Balance</li> <li>▪ Inventory Transactions</li> </ul>

<b>Finance</b>	<ul style="list-style-type: none"> <li>▪ Receivables</li> <li>▪ Payables</li> <li>▪ General Ledger</li> <li>▪ COGS</li> </ul>
<b>Call Center</b>	<ul style="list-style-type: none"> <li>▪ ACD Events</li> <li>▪ Rep Activities</li> <li>▪ Contact-Rep Snapshot</li> <li>▪ Targets and Benchmark</li> <li>▪ IVR Navigation History</li> <li>▪ Reve</li> </ul>
<b>Service</b>	<ul style="list-style-type: none"> <li>▪ Service Requests</li> <li>▪ Activities</li> <li>▪ Agreements</li> </ul>
<b>Workforce</b>	<ul style="list-style-type: none"> <li>▪ Compensation</li> <li>▪ Employee Profile</li> <li>▪ Employee Events</li> </ul>

<b>Pharma</b>	<ul style="list-style-type: none"> <li>▪ Prescriptions</li> <li>▪ Syndicated Market Data</li> </ul>
<b>Financials</b>	<ul style="list-style-type: none"> <li>▪ Financial Assets</li> <li>▪ Insurance Claims</li> </ul>
<b>Public Sector</b>	<ul style="list-style-type: none"> <li>▪ Benefits</li> <li>▪ Cases</li> <li>▪ Incidents</li> <li>▪ Leads</li> </ul>
<b>Modular Data Model includes:</b>	<ul style="list-style-type: none"> <li>~350 Fact Tables</li> <li>~550 Dimension Tables</li> <li>~5,200 Pre-Built Metrics</li> <li>(2,500+ are derived metrics)</li> <li>~15,000 Data Elements</li> </ul>

## OBAW / Oracle BI Applications Pros and Cons

- Pros are mainly around saving you time
  - ▶ Reduces the time required to deliver the core elements of your data warehouse
  - ▶ If you are on vanilla EBS, SAP, PSFT extra much of this can be delivered in weeks
  - ▶ Provides a design and ETL methodology
  - ▶ Comes with Informatica PowerCenter, a high-end ETL tool
- Cons are mostly around cost
  - ▶ Costs around \$3k per analysis module per named user
  - ▶ Most implementations require extending and customizing
  - ▶ Major benefit is when your source is vanilla EBS, PSFT, SAP etc

## Build vs. Buy #2: Oracle Optimized Warehouse Initiative

- Part of recent moves by Oracle to take the guesswork out of data warehouse configuration
  - ▶ Customers can buy any combination of hardware components to build a data warehouse
  - ▶ Some percentage of customers will end up with poorly configured data warehouses
- Oracle's solution is the "Optimized Warehouse Initiative"
- Optimized Warehouse Reference Configurations
  - ▶ Best practices and reference configurations
- Oracle Optimized Warehouse
  - ▶ Created in partnership with hardware vendors
  - ▶ Standard set of prebuilt and pre-configured hardware for various DW sizes, throughputs, budgets



## Build vs. Buy #3: HP Oracle Database Machine

- Data Warehouse appliance
- Pre-balanced and integrated components
- Approx \$16k per Terabyte
- Pre-integrated, pre-configured solution for larger customers
- 8 DL360 Oracle Database servers
  - ▶ 2 quad-core Intel Xeon, 32GB RAM
  - ▶ Oracle Enterprise Linux
  - ▶ Oracle RAC
- 14 Exadata Storage Cells
  - ▶ 50 to 168 TB raw storage
- 4 InfiniBand Switches
- Ability to add more racks for balanced capacity upgrades



## Summary

---

- Data Warehouses are typically designed with three layers: staging, ODS and analytic
- With Oracle Database 11g, Oracle BI EE and Oracle Fusion Middleware, this model has evolved, and data can now come in via a number of non-relational routes
- The semantic model provided with OBIEE can provide additional options around delivery, particularly around agile development and on-the-fly data integration
- Oracle's EPM tools add planning and budgeting functionality to the BI/DW stack, and provide a single, unified Enterprise Performance Management Workspace
- The Oracle Business Analytics Warehouse, the Oracle Optimized Warehouse Initiative and the HP Oracle Database Machine can provide a means to deliver faster
- Thank you for inviting me over to deliver this presentation
- Visit our website for presentations, papers, and the Rittman Mead Blog  
<http://www.rittmanmead.com>, contact me at [mark.rittman@rittmanmead.com](mailto:mark.rittman@rittmanmead.com)



## A Future Oracle BI/DW Architecture

Mark Rittman, Director, Rittman Mead Consulting  
Philadelphia Oracle Users Group, October 2008