OLAP APPLICATIONS, BIBEANS, AND JAVA OLAP API

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PREFACE

At the time of this writing (February, 2001), Oracle 9i is still in development. Limited access to information has prevented a thorough review of Oracle 9i OLAP Services, the Java OLAP API and BI Beans. More information should be available once beta copies of Oracle 9i become available. The presentation presented at IOUG-A Live! will include more information than is available in this paper.

INTRODUCTION

With the release of Oracle 9i and OLAP Services, Oracle has finally achieved their long term goal of integrating OLAP with relational. Oracle9i combines the best of Express Server - support for complex multidimensional queries and rapid query response - with the highly scaleable, manageable, and secure Oracle database. Oracle9i is the first OLAP-ready relational database.

This presentation includes an overview of the various architectural components.

OLAP AND ORACLE 9I – WHAT IS IT?

Businesses need to analyze their businesses in ways that decision makers at all levels can quickly respond to changes in the business climate. While a standard transactional query might ask, "How many bolts were sold last month?" An analytical query might ask, "How do sales in the Midwest for the last 3 months compare with the forecast? Now how does that compare to a year ago?"

Analytical queries require an online analytical processing (OLAP) solution. Oracle 9i provides comprehensive support for OLAP:

- The Oracle relational database management system (RDBMS) remains the most efficient and secure way to store your data. By developing a data warehouse, you can provide data in a form suitable for business analysis.
- OLAP Services provides a Java OLAP API and an analytical engine. OLAP Services provides the means to build analytical applications that support complex statistical, mathematical, and financial calculations along with predictive analytical functions such as forecasting, modeling, consolidations, allocations, and scenario management. Because the OLAP API is all Java, OLAP Services supports deployment of analytical applications to large, geographically distributed user communities on the Internet.
- The Oracle BI Beans complements OLAP Services by providing pre-built Oracle JDeveloper or other Java development environments to build analytical applications, which can be deployed as either Java or HTML ("thin") clients.

OLAP SERVICES

Oracle9i OLAP Services provides the query performance and calculation capability of a multidimensional database. In addition, it provides a Java OLAP API that is appropriate for the development of internet-ready analytical applications.

Unlike other marriages of OLAP and RDBMS technology, Oracle9i OLAP Services is not a thinly disguised multidimensional database using bridges to move data from the relational data store to a multidimensional data store. Instead, it is truly an OLAP enabled relational database.

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As a result, Oracle9i provides the performance and calculations of a multidimensional database along with the scalability, accessibility, security, manageability, and high availability of the Oracle9i database.

In its broadest definition, OLAP Services consists of the following components: the Oracle Java OLAP API, one or more OLAP services that run as child processes of a database instance, a metadata repository in each database instance, and tools within Oracle Enterprise Manager for creating OLAP metadata and managing OLAP services.

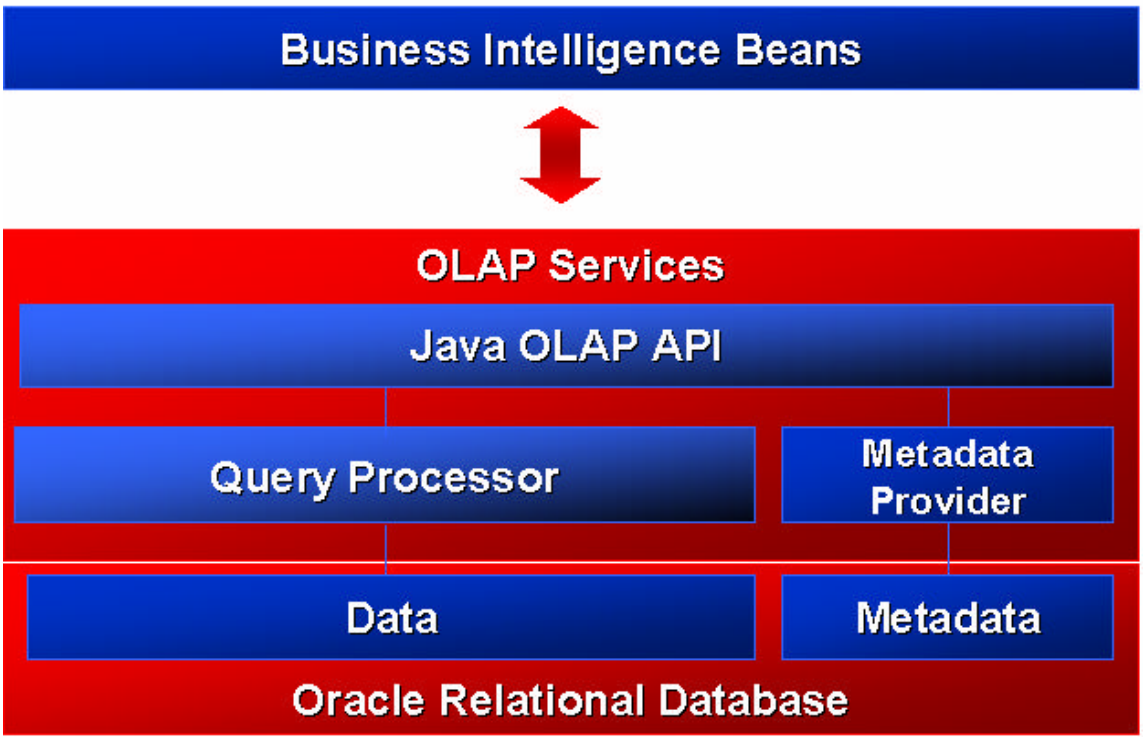

Figure 1. Oracle 9i and OLAP Services Architecture

ADMINISTRATION

Administration of OLAP Services consists of the following tasks:

- Acquiring System Administration Privileges
- Starting OLAP Services
- Stopping or Pausing OLAP Services
- Changing the Configuration Settings
- Managing Sessions
- Viewing Status Messages
- Granting Access Rights to Users
- Running Batch Jobs
- Scheduling Jobs
- Managing the Service Environment
- Managing OLAP Services Agent
- Creating Databases (Metadata, dimensions, Measures and Cubes)

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All database administration tasks are accomplished in Oracle Enterprise Manager. Using Oracle Enterprise Manager 9i, the database administrator prepares the database for analysis by:

- Defining dimensions. In Oracle9i, dimensions are extended to support Oracle9i OLAP Services.
- Defining cubes. Cubes define the relationship between dimension tables and fact tables. That is, they define the joins between key columns in a fact table with key columns in a dimension lookup table. In addition, cubes define measures. Measures are derived from fact columns, however they contain additional meta data such as aggregation methods, calculation hierarchies, and solve orders which is can be used by Oracle9i OLAP Services.
- (Note that a cube is a meta data object rather than physical data storage. The physical storage of data is in fact tables and materialized views.)
- Materialized views, which store summary data.
- Measure folders, which provide a means of organizing measures for applications and/or users.
- Meta data is saved in both CWM and the Oracle data dictionary. CWM automatically synchronizes CWM and the data dictionary should there be a change to either.
- Job scheduling is also managed in Oracle Enterprise Manager, with its metadata being saved in the OEM repository.

All of the tools that you use to manage OLAP services are integrated into Oracle Enterprise Manager (OEM). You do not need to use a separate set of tools.

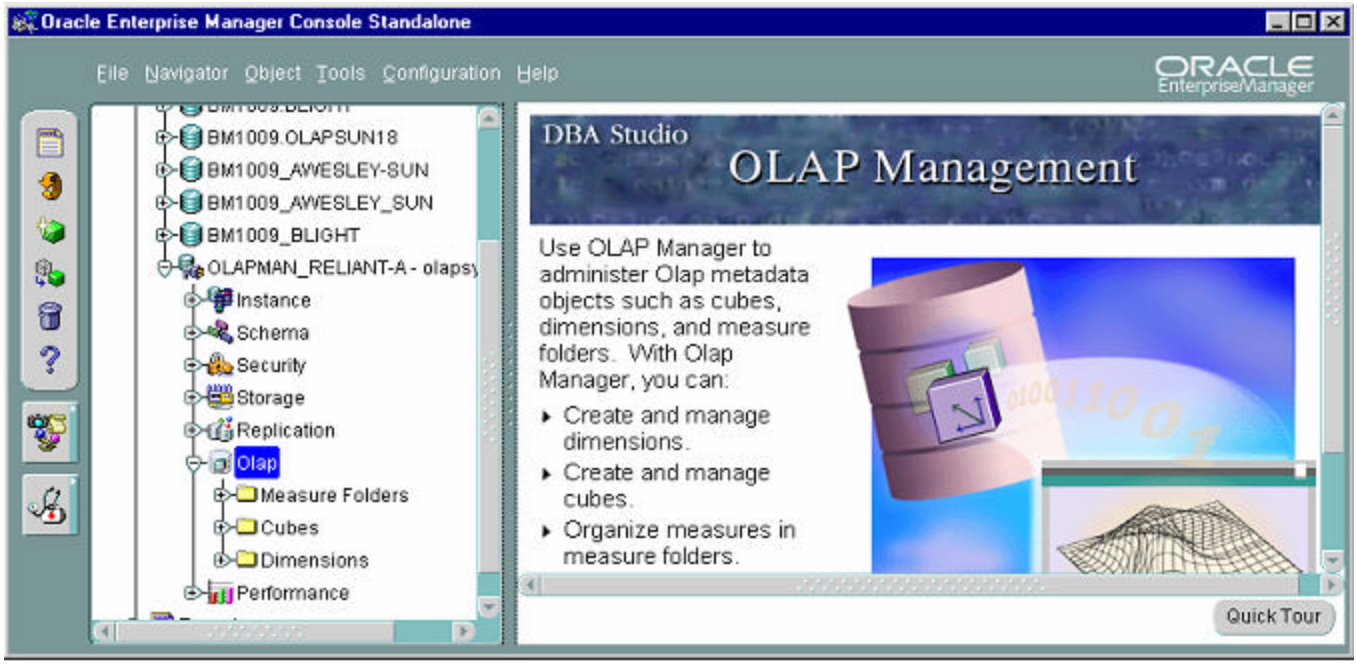

Figure 2. OEM and OLAP Manager

RDBMS ENHANCEMENTS

Key to Oracle9i OLAP Services are enhancements made to the relational data store and SQL.

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First, the relational database has been optimized for high performance cell access. This is extremely important since analytical applications typically require extremely rapid access to data throughout the multidimensional data model. The data required for any particular analytical query might come from anywhere in the cube, for example data might be needed from many different levels within the multidimensional model.

It is this quick access to random cells in the multidimensional model that has been the mainstay of multidimensional databases. Once you have the data, performing the calculations is typically trivial. By providing high performance cell access within the multidimensional model, Oracle9i provides a solid foundation for Oracle9i OLAP Services.

This high performance cell access is provided by optimized star query performance supported by bitmap join indexes and optimizations to IN LIST selections.

In addition, new SQL functions have been added which allow Oracle9i OLAP Services to process more quires in the RDBMS. This eliminates the need to move large volumes of data into OLAP Services for queries such as sophisticated rankings and time series calculations. In addition, it allows OLAP Services to leverage scalability features in the RDBMS such as parallelism.

SQL functions lead/lag, row number, rank, percentile, moving average, and cumulative sum are just a few examples of OLAP functions that have been implemented in SQL.

These functions benefit OLAP Services by allowing more queries to be satisfied efficiently in SQL, closest to the data in the database. Ranking is a perfect example, since a ranking queries requires 'touching' very large volumes of data. Anytime a query can be efficiently processed in the RDBMS, OLAP Services performance is enhanced.

METADATA

There are two primary forms of OLAP metadata in the 9i platform:

- Java OLAP API metadata data providers.
- The BI Beans runtime repository.

The Java OLAP API metadata provides describe the multidimensional model and data sources to the Java OLAP API. Once in the Java OLAP API, the multidimensional model is exposed to the application using the API's Multidimensional Metadata model (MDM). The MDM presents a unified image of all data sources and fully insulates the application from the data source and the physical storage of the data (for example, the schema in the relational database).

The BI Beans repository is also in the Oracle database. It is used to store analytical objects (tables, cross tabs, graphs, calculations, queries) that have been defined by the application developer or end user. All objects are saved as XML. These objects can then be deployed using a variety of methods (Java applications, HTML, to PDAs, etc) by applications. The BI Beans repository can be in an instance of Oracle that is different from an OLAP Services instance, and can service many instances of OLAP Services.

JAVA OLAP API

The Oracle OLAP API is a Java programming interface to OLAP Services. The analytical BI Beans are built using this API; you can extend (or even replace) the functionality provided by the BI Beans by using Java classes.

The Oracle Java OLAP API is designed from the 'ground up' for OLAP. It is a modern Java, object-oriented API. It provides a simple means of expressing complex multidimensional queries containing with high analytic content.

The Java OLAP API complements the new SQL analytical functions the relational database. Relatively simple analytical applications might choose to use SQL, while more sophisticated analytical applications will use the Java OLAP API. OLAP Services will make significant use of new SQL analytical functions in the relational database

Key features of the Java OLAP API include:

- A multidimensional object model. Other Java OLAP API APIs do not provide an object model - it's up to each application to implement one. This is not a trivial task.

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- A complete set of OLAP calculation functions (for example, statistical, mathematical, financial, and time series functions).
- Support for asymmetric queries. For example, nested rankings.
- Calculated (virtual) dimension members that can be used just as stored dimension members.
- Incremental query construction. For example, select all products at the Item level, keep products where sales grew 50% or more as compared with last year, remove products with a margin of less than 25%.
- Multidimensional cursors allow an application to request a subset of data within the users query (for example, only those cells of data which can actually be displayed on the users monitor). This offers significant performance tuning opportunities to the application developer.

BI BEANS

To meet the needs of the marketplace, Oracle is developing BI Beans. These components enable the rapid development of OLAP applications. The combination of the Java OLAP API and Common Warehouse Metadata provide APIs that make the BI capabilities of those servers accessible to Java programmers. The role of BI Beans is to complete the engine-API-tools offering by providing the following:

- Graphical views of OLAP data including a pivot table and rich business charts
- User interfaces for easily formulating OLAP queries, calculations, sorting criteria and other analytic functions, both at application design-time and at run-time
- Support for visual programming using Java integrated development environments (IDE)
- Support for building Internet computing-compliant n-tier OLAP applications
- Interoperability with third-party components through support for open standards, notably Beans, CORBA/IIOP and InfoBus

The Oracle Java Tools will provide a tools infrastructure (IDE, repository, n-tier development, modeling, etc.) that will enable developers to build applications that take advantage of Internet computing. The BI Beans leverage the services provided by Java and fit naturally into the Java environment. People who become proficient in developing applications using Java will be able to construct robust BI applications without having to learn separate tools or infrastructure-related concepts.

Key Features of BI Beans:

- Support visual development
- Transform any Java IDE into a powerful OLAP development tool
- Standard pages without programming
- Optimized for Oracle environments
- Open, standards-based
- Beans: properties, methods, and events
- Property Editors and Customizers
- InfoBus for standard data flow
- BI functionality can be built into any Java based application including Relational based applications

Oracle's JDeveloper will be enhanced with design-time running of objects, wizards for creation of "BI Pages" and a rich set of customizers and property editors to allow for very rapid BI application development.

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ROBUST SET OF ANALYTICAL COMPONENTS

The first release of the BI Beans focuses on the most common BI components used in analytical applications today. In particular, the following JavaBean components are planned:

DATABASE CONNECTION

The Database Connection bean connects the application to a particular database. It provides the following functionality: 1) management of connection information, 2) user authentication support, 3) access to aggregated classes that provide the ability to query the data dictionary and 4) Express SPL support

DATASOURCE

The DataSource provides access to information contained in a multi-dimensional query, and provides methods to access, modify and manipulate that information. It is the source of data for the Crosstab and Graph bean and supports different types of data navigation, like drill down and pivoting. The QueryBuilder bean is the component that enables a user to graphically define the DataSource's contents (the data to display, the selections for each of the dimensions, and the layout of the information). The DataSource offers industry standard data access mechanisms. It is an InfoBus data producer, which means that an InfoBus consumer (like a spreadsheet control) can access information from the DataSource using the InfoBus APIs, without having to understand the DataSource's native interface.

CROSSTAB

The Crosstab presents data in a spreadsheet-like display. It enables users to easily navigate through their business data, using familiar methods like drill down and pivot. The Crosstab provides rich support for data formatting, including various number formats, fonts and cell colors. It also supports a wide breadth of events that enable Java programmers to provide further customizations. The Crosstab is a derivative of the PivotTable JavaBean developed by Oracle's Bali group.

GRAPH

The Graph presents data in a variety of two and three dimensional chart formats, including bar, pie, line, area, stock market, bubble charts and more. Like the Crosstab, the graph enables users to easily navigate through their business data. The graph supports a wide breadth of events that enable Java programmers to provide further customizations.

QUERYBUILDER

The QueryBuilder is a re-entrant wizard that enables a user to define and modify a multi-dimensional query. Users pick the data to display, the layout for the data (e.g. across time broken out by product), and the selections for each of the dimensions. The QueryBuilder provides the ability to perform the following types of analytical queries: top/bottom, exception, family, attributes, text matching and more. The QueryBuilder is often viewed as the heart of an analytical application and is a true differentiator of Oracle's BI technology.

DIMENSION LIST BOX

The Dimension List Box enables a developer to easily create a List Box that contains a set of dimension values. The dimension values can be presented in a hierarchical list, enabling users to drill to values of the dimensions. It is optimized to handle extremely large lists of values.

CONCLUSION

With the release of Oracle 9i and OLAP Services comes a new way to build the next generation of BI applications. Java Development Environments (JDEs), such as Oracle's JDeveloper will be able to use the Java OLAP API components, BI Beans and Oracle 9i components to develop fully integrated applications. Seamless integration of relational and multidimensional data will finally be a reality.

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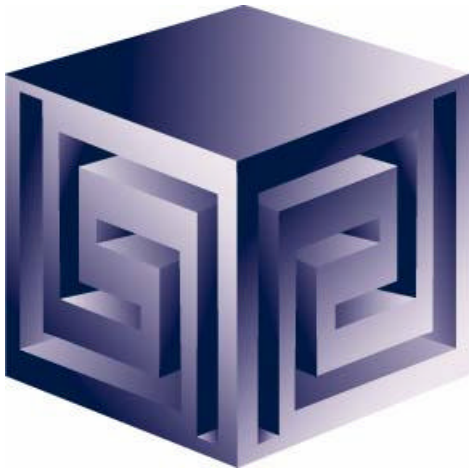

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Vlamis Software Solutions, Inc.

- **Founded in 1992 in Kansas City, Missouri**
- **A Member of Oracle Partner Program since 1995 along with various Oracle Beta Programs**
- **Designs and implements databases/data marts/data warehouses using RDBMS and Multidimensional tools**
- **Specializes in Data Transformation, Data Warehousing, Business Intelligence, Oracle Financials and Applications Development**
- **Chris Claterbos has been working with Oracle Technologies since 1980. Has been a DBA for 20 years.**
- **Oracle Certified Solutions Provider**

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Disclaimer

Oracle 9i is still in Development and all statements, illustrations and features shown during this presentation are subject to change.

Agenda

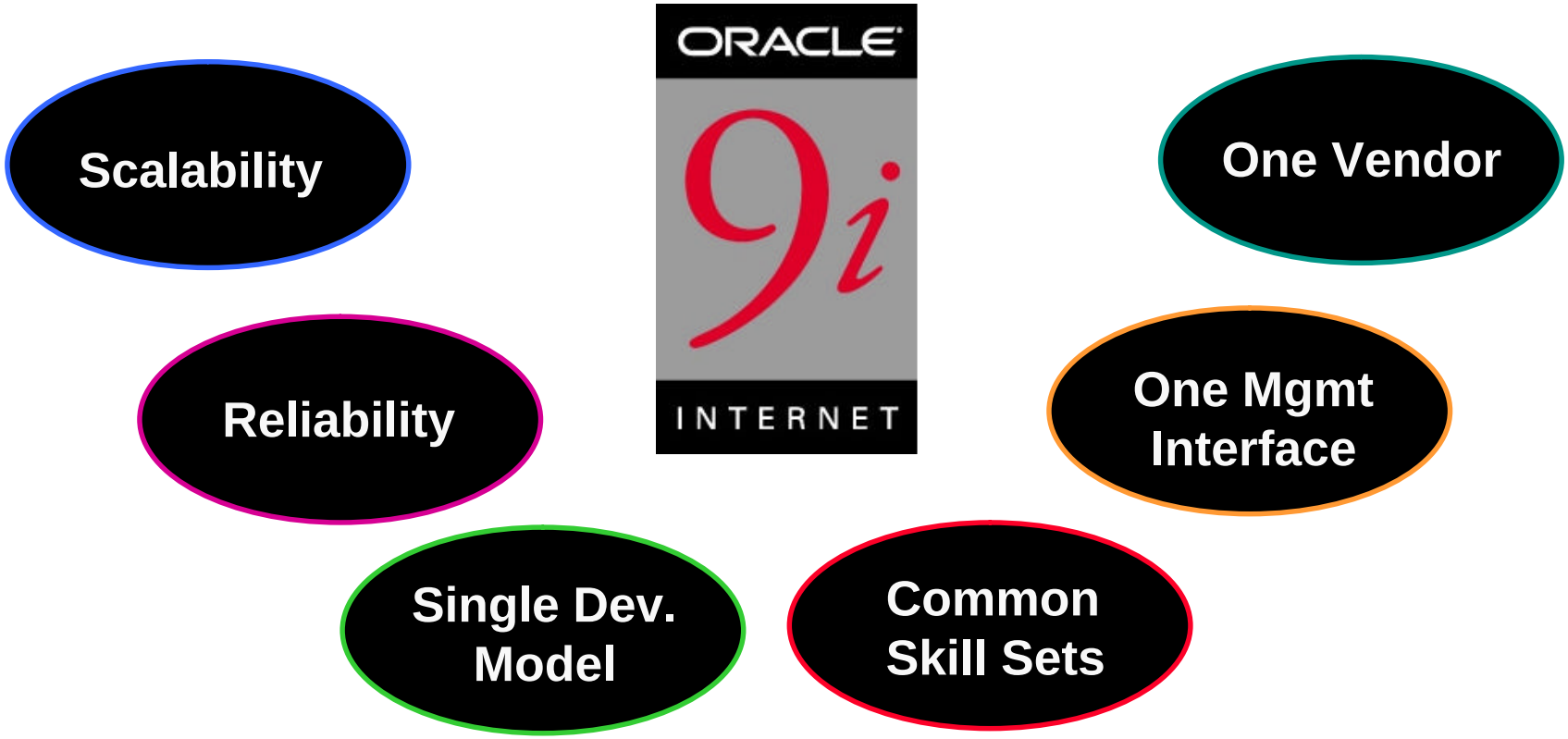
- Introduction/Overview
- Oracle 9i & OLAP
- OLAP Ready RDBMS
- Advanced Analytics - Overview
- Administration
- Java OLAP API
- Application Development
  - What are BI Beans
  - Sample applications
  - Developing Applications
- Summary/Conclusion

DSS Development Themes

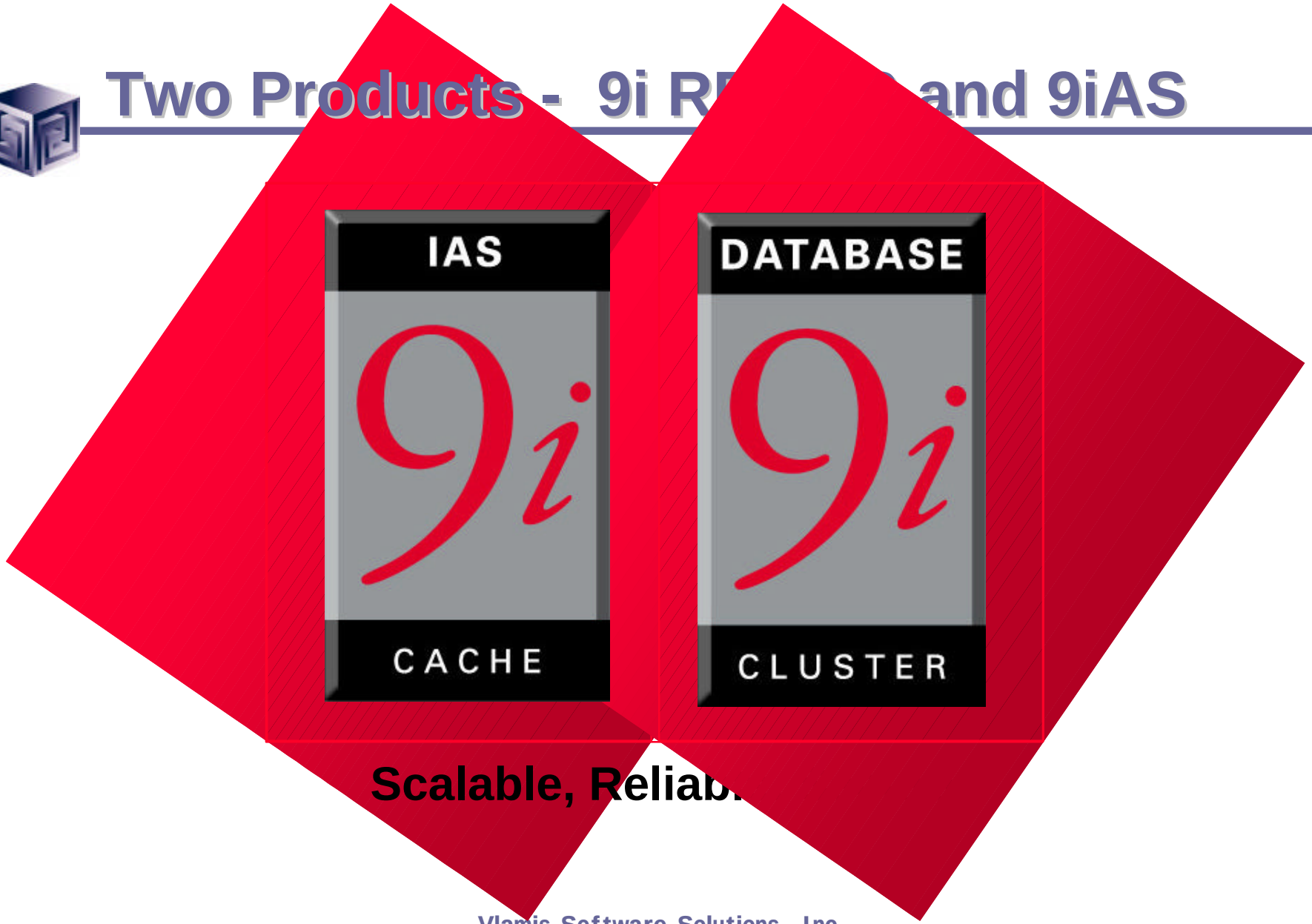
Focus on:

- **Web Architecture**
- **Ease of use**
- **Analytical functionality**
- **Improve performance**
- **Use of common standards**
- **Integration with Internet Computing topologies**
- **Integration of Oracle Tools and Java components**

Oracle 9i Platform Eliminates the Chaos

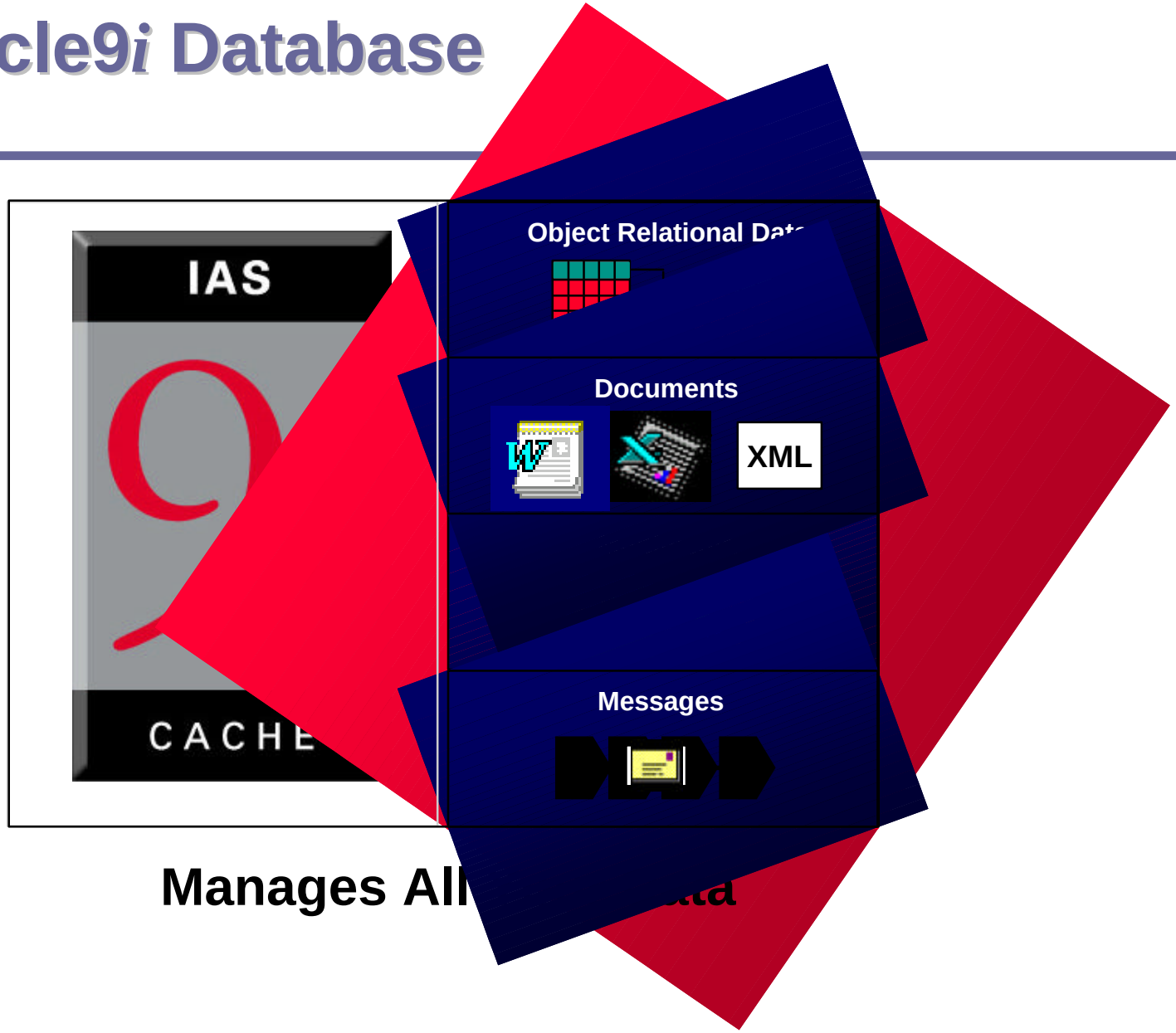


Two Products - 9i R[illegible] and 9iAS



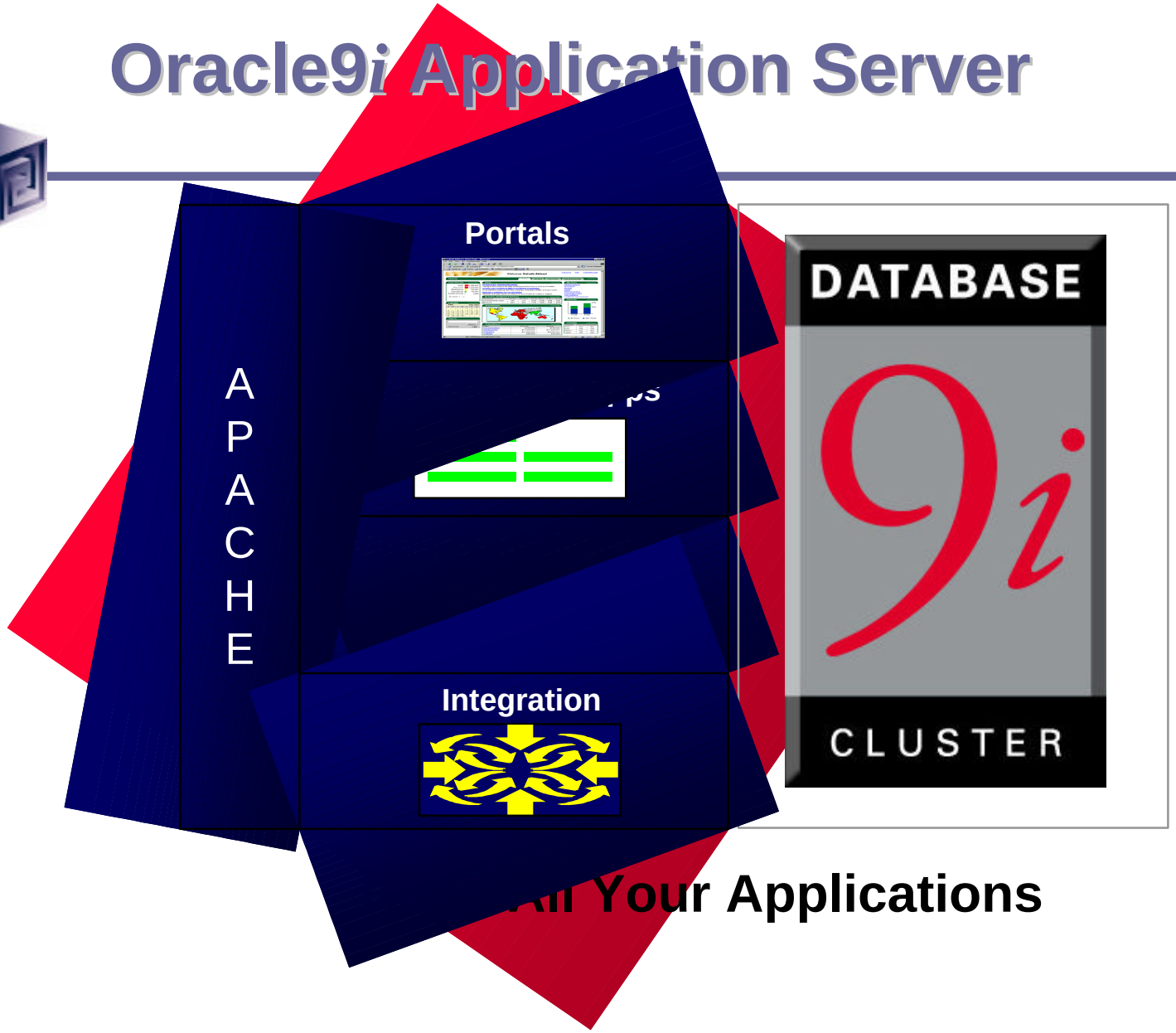
Scalable, Reliab[illegible]

Oracle9*i* Database



Manages All

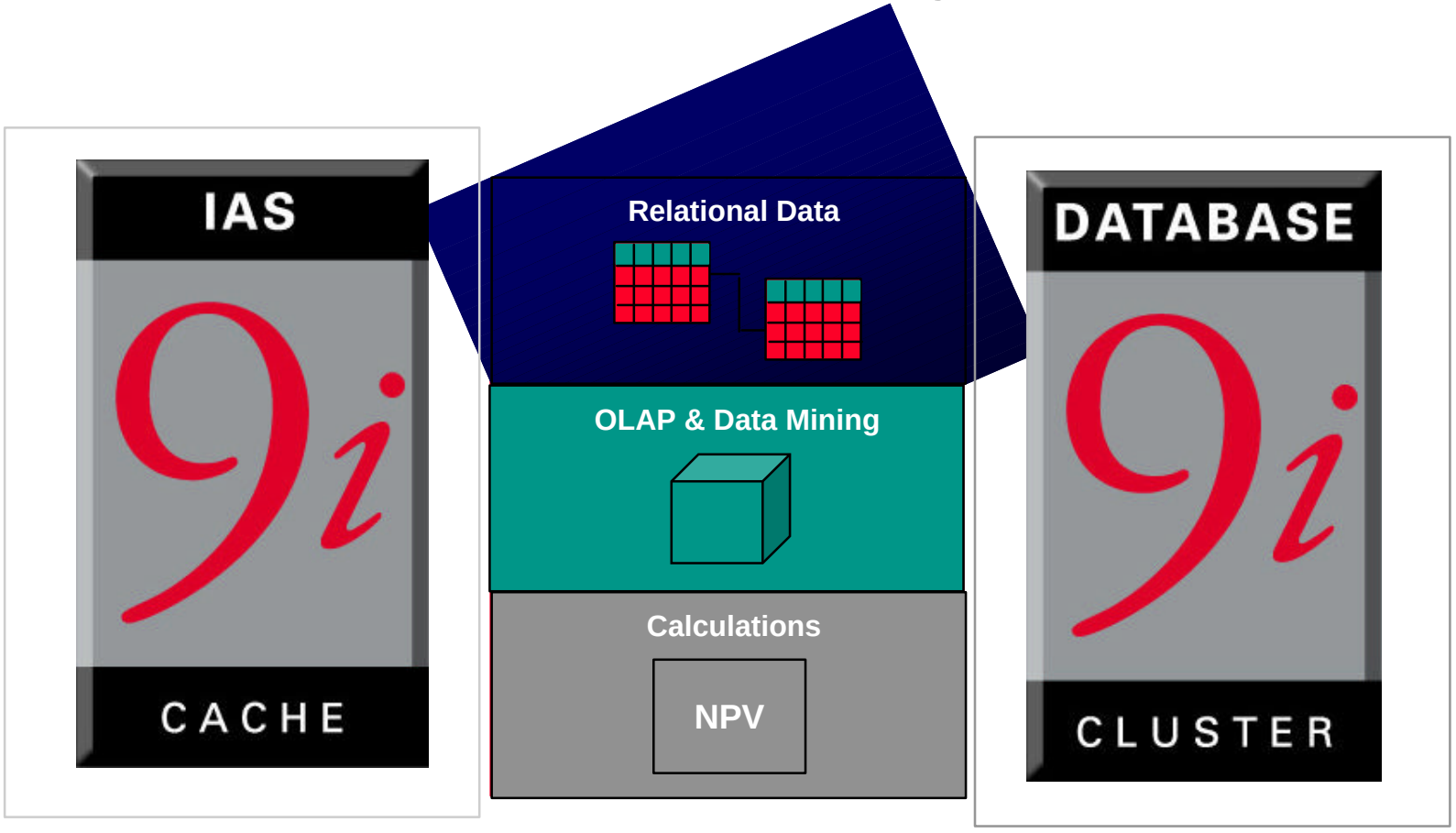
Oracle9*i* Application Server



Your Applications

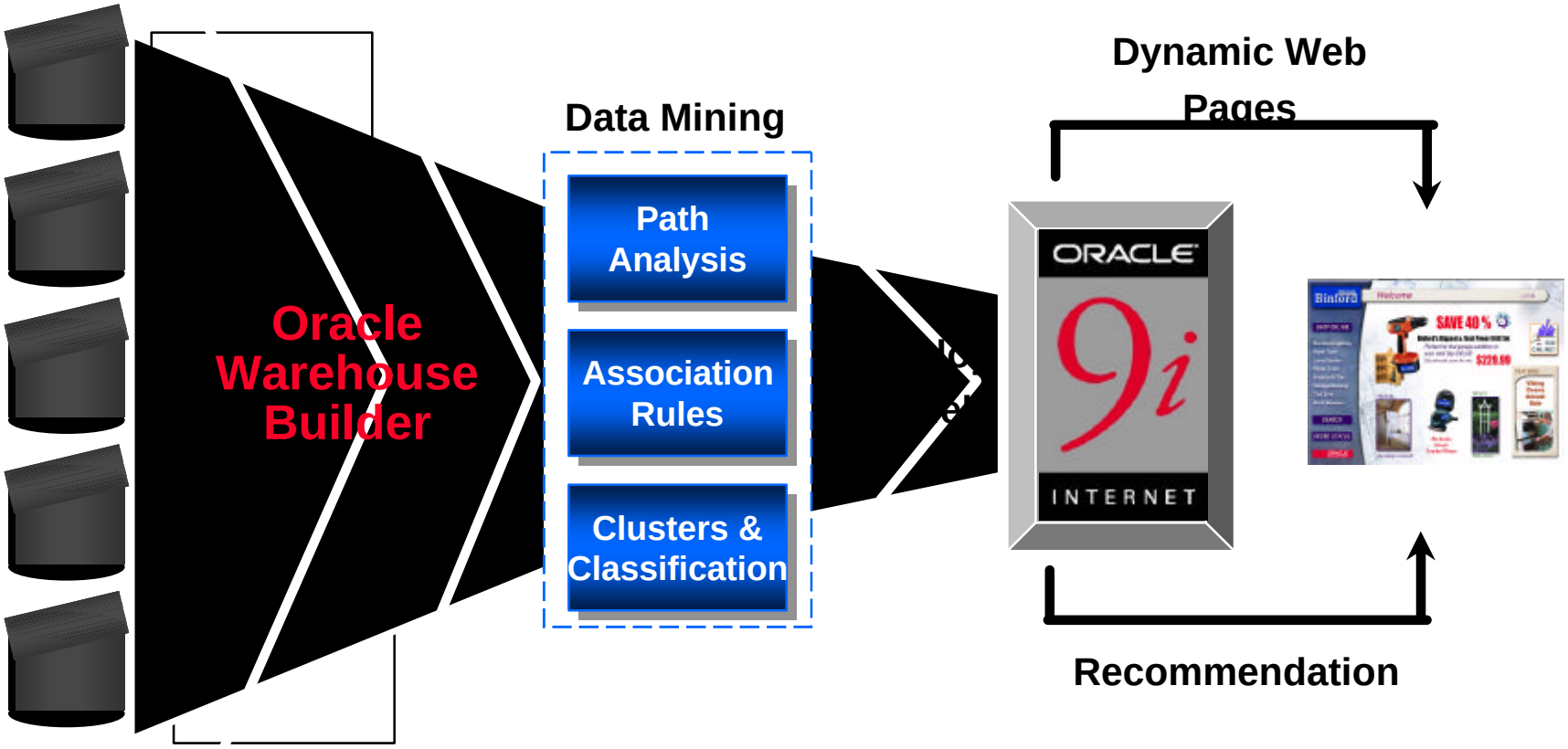
Intelligence, All In the Database

- **Embeds OLAP & Data Mining**



Intelligence, Personalize By User

- **Personalize Web Sites In Real Time**



Oracle Relational Database

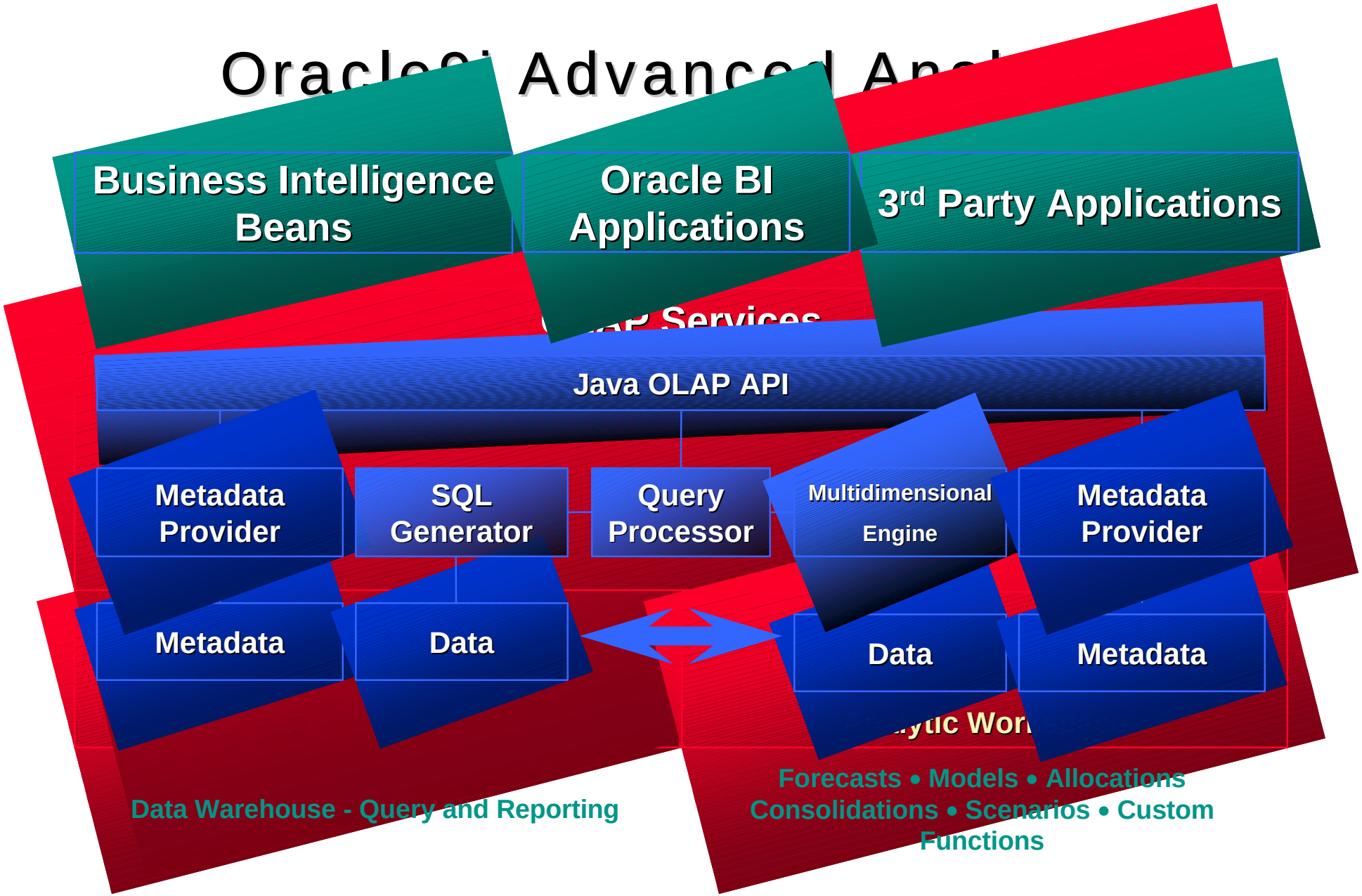
- **High performance cell access**
  - **Optimized star-query performance**
    - **Bitmap indexes and bitmap join indexes**
    - **IN-list optimizations**
- **Calculations using SQL**
  - **Rank, percentile, inverse percentile**
  - **Moving average, cumulative sum**
  - **Lag/lead**
  - **Ratio-to-report**

Oracle Relational Database

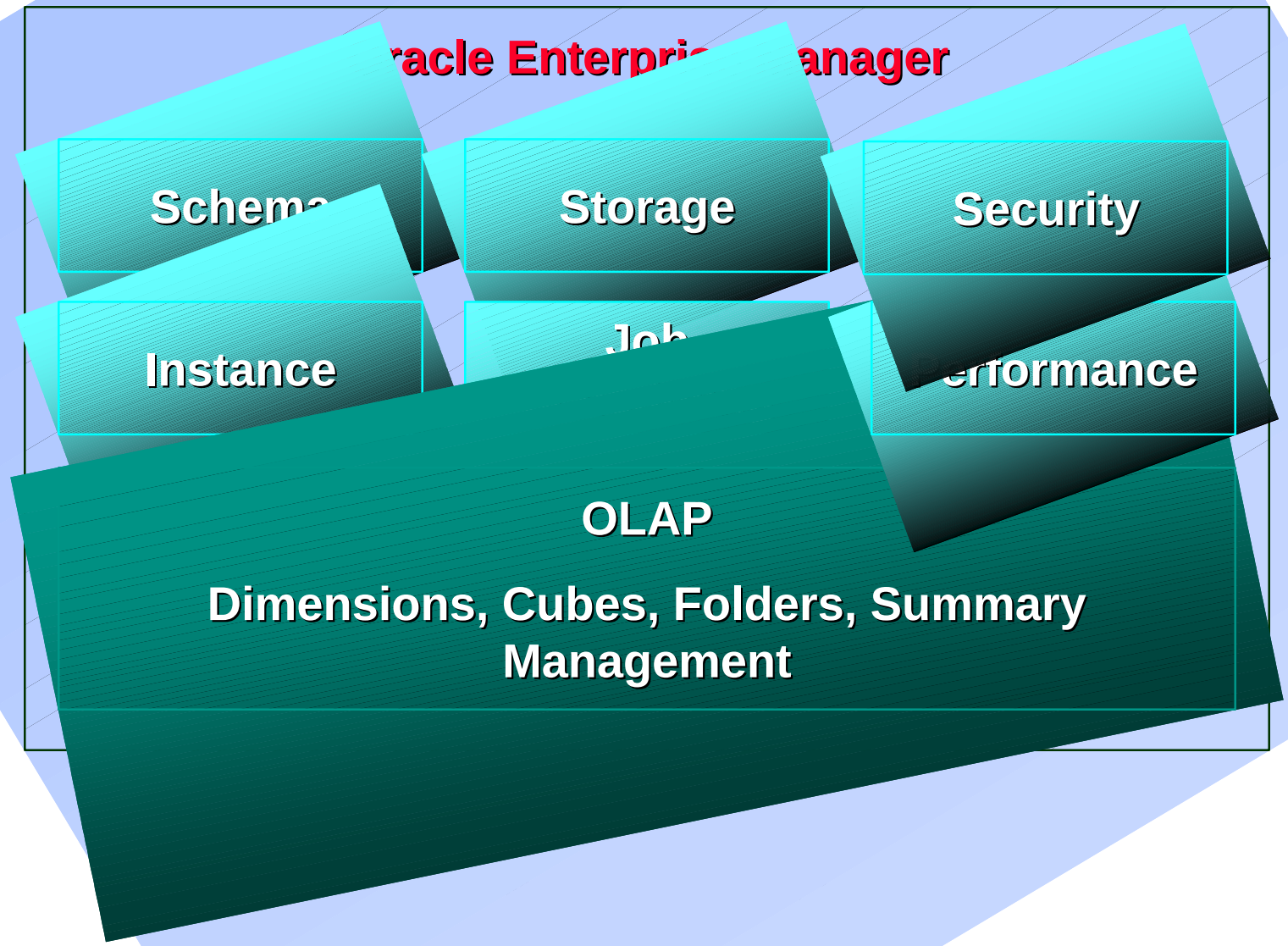
- **Scaleable data storage**
  - **Support for multi-terabyte data sets**
    - **Robust partitioning, Proven parallel-execution architecture, Any hardware platform**
- **Summary management**
  - **Optimized computation of aggregates**
    - **Grouping sets, Concatenated grouping sets**
  - **Materialized views**
    - **Fast, incremental refresh of aggregates**

Oracle9i Advanced Analytics

- **Analysis ready Oracle database**
  - **Support for complex, multidimensional queries**
  - **Support for complex calculations**
  - **Highly scaleable**
- **Development platform for Internet-ready analytical applications**
  - **Java OLAP API**
  - **Business Intelligence Beans and JDeveloper**


Business Intelligence Beans
Oracle BI Applications
3rd Party Applications
Java OLAP API
Metadata Provider
SQL Generator
Query Processor
Multidimensional Engine
Metadata Provider
Metadata
Data
Data
Metadata
Data Warehouse - Query and Reporting
Forecasts • Models • Allocations
Consolidations • Scenarios • Custom Functions

Adm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Schema
Storage
Security
Instance
Job
erformance
OLAP
Dimensions, Cubes, Folders, Summary Management

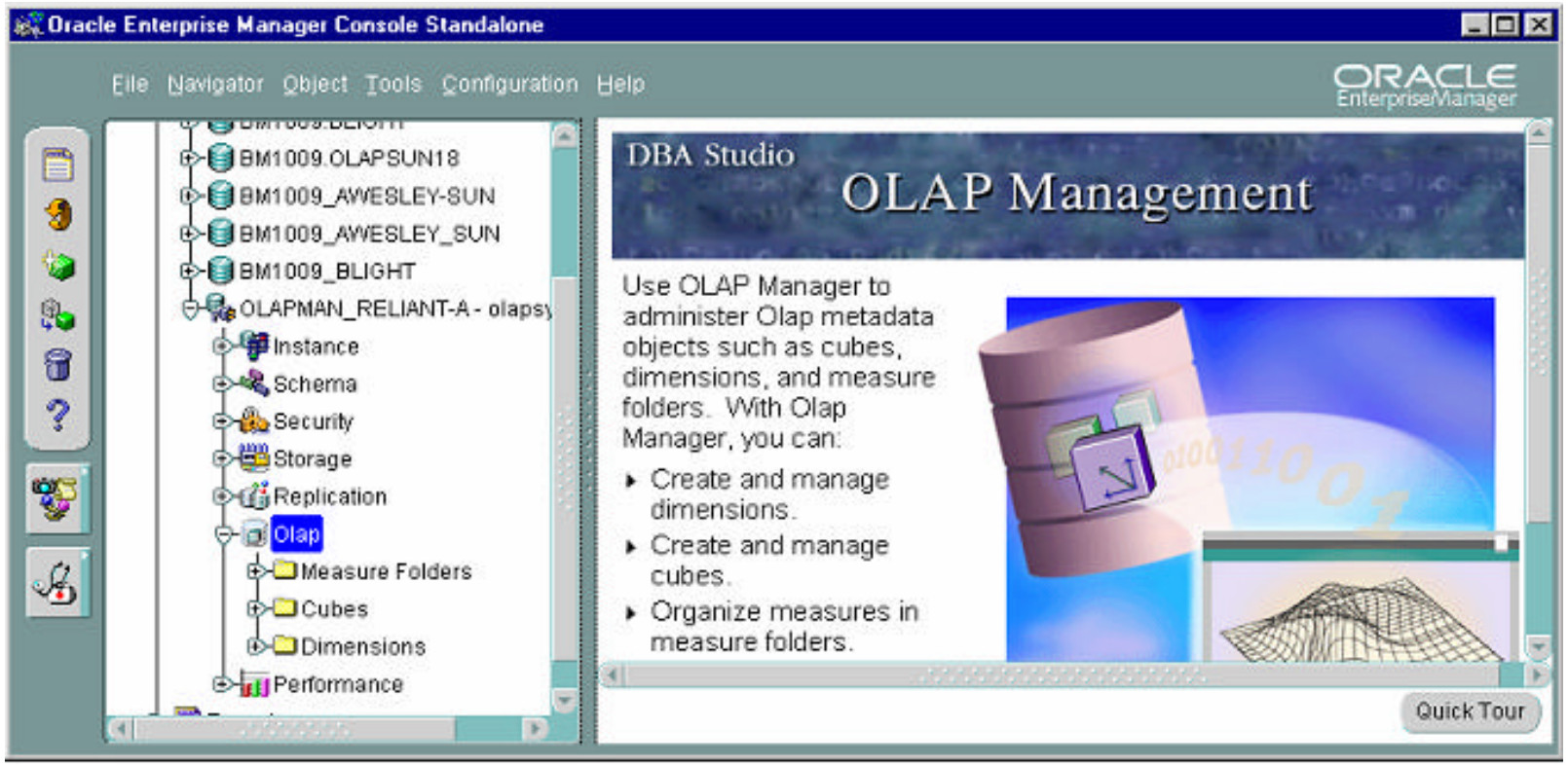
Administration with OEM

- Acquiring System Administration Privileges
- Starting / Stopping / Pausing OLAP Services
- Changing the Configuration Settings
- Managing Sessions
- Viewing Status Messages
- Granting Access Rights to Users
- Creating Databases (Metadata, dimensions, Measures and Cubes)
- Running Batch Jobs
- Scheduling Jobs
- Managing the Service Environment
- Managing OLAP Services Agent

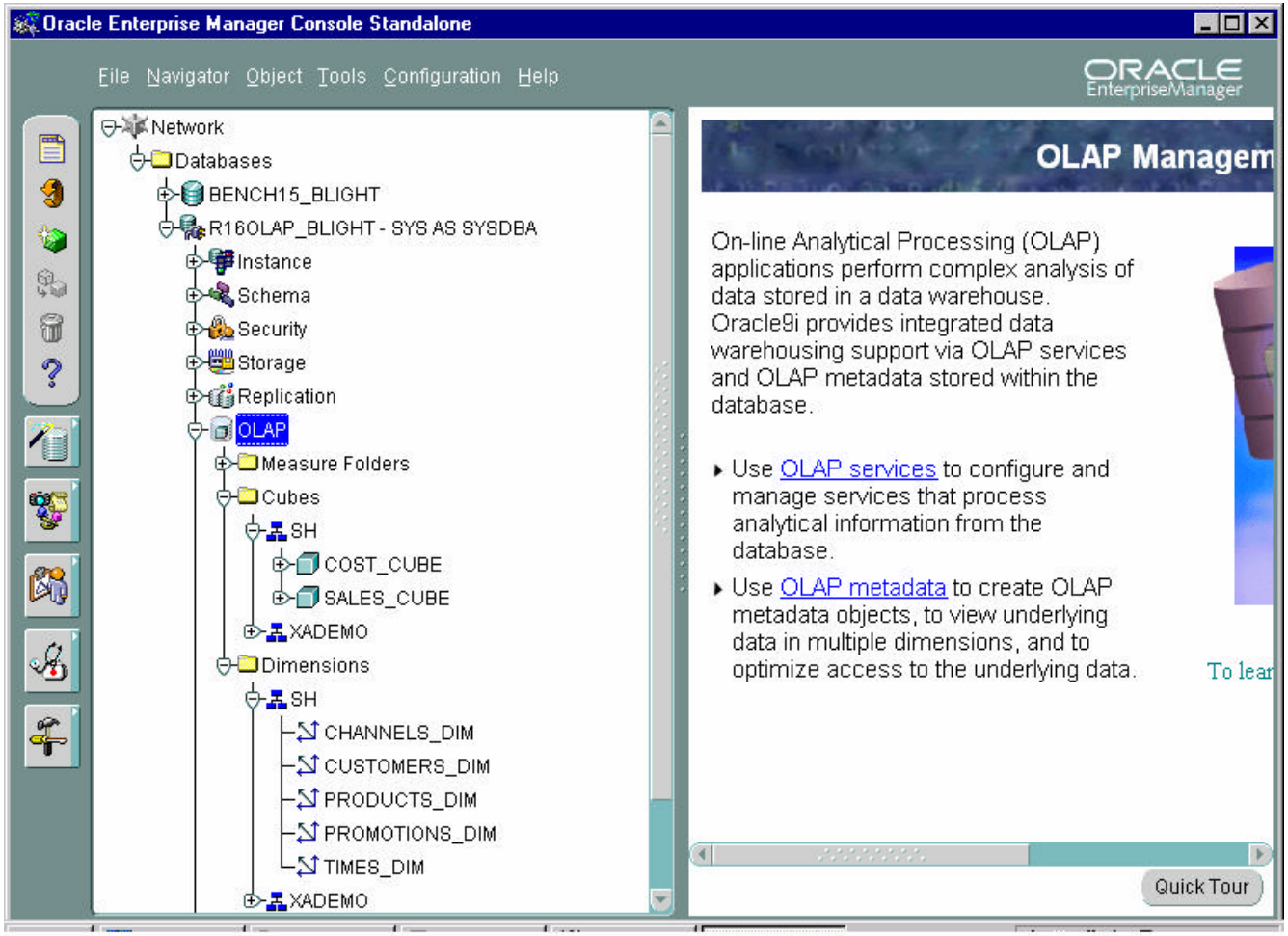
Advanced Analytics Administration

SCREENS

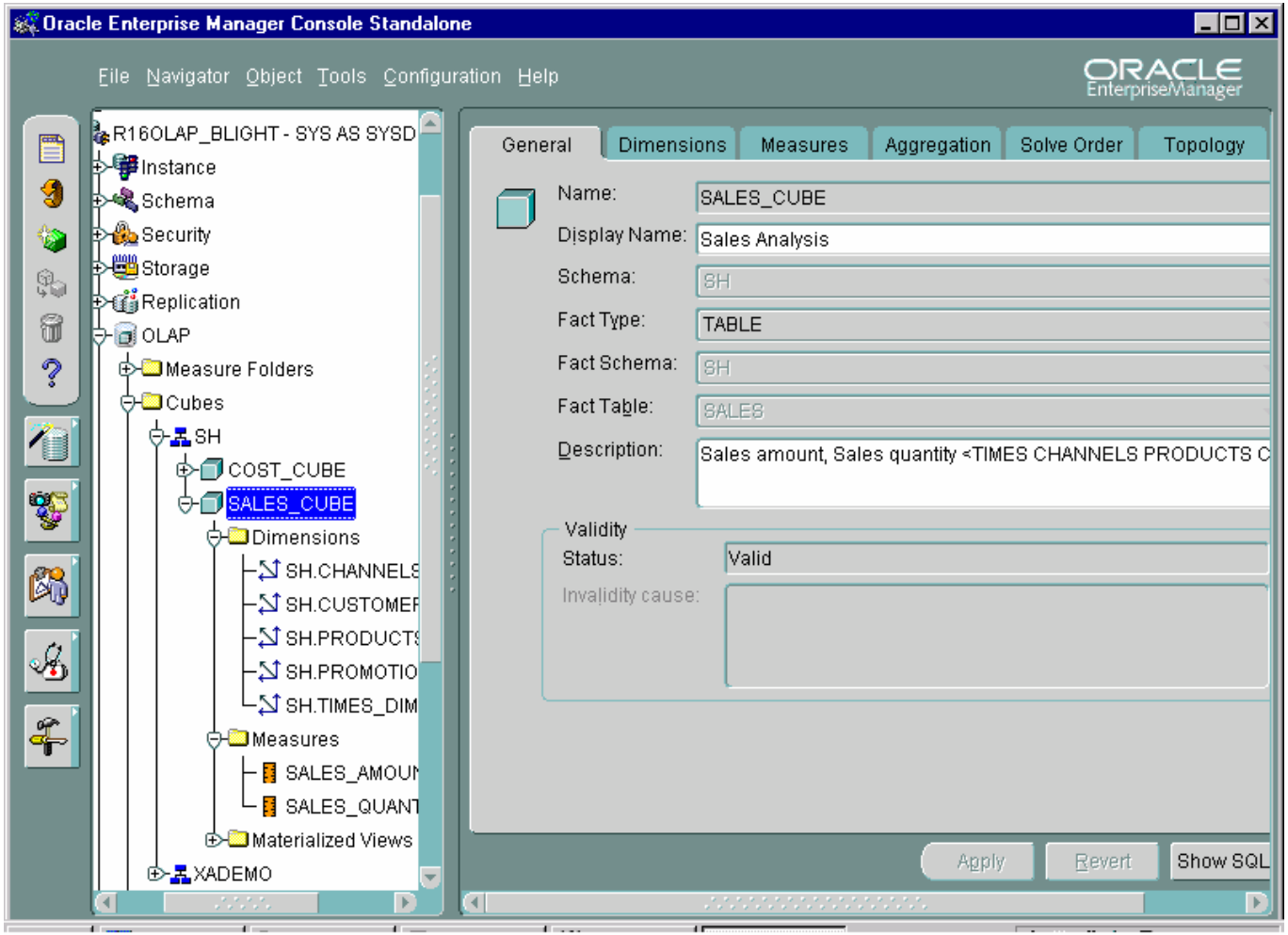
OEM / DBA Studio – OLAP Mgmt



OLAP Objects



OLAP Cube


Oracle Enterprise Manager Console Standalone
File Navigator Object Tools Configuration Help
ORACLE EnterpriseManager
R16OLAP_BLIGHT - SYS AS SYSD
Instance
Schema
Security
Storage
Replication
OLAP
Measure Folders
Cubes
SH
COST_CUBE
SALES_CUBE
Dimensions
SH.CHANNELS
SH.CUSTOMER
SH.PRODUCTS
SH.PROMOTIO
SH.TIMES_DIM
Measures
SALES_AMOUN
SALES_QUANT
Materialized Views
XADEMO
General
Dimensions
Measures
Aggregation
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Name:
SALES_CUBE
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SALES
Description:
Sales amount, Sales quantity <TIMES CHANNELS PRODUCTS C
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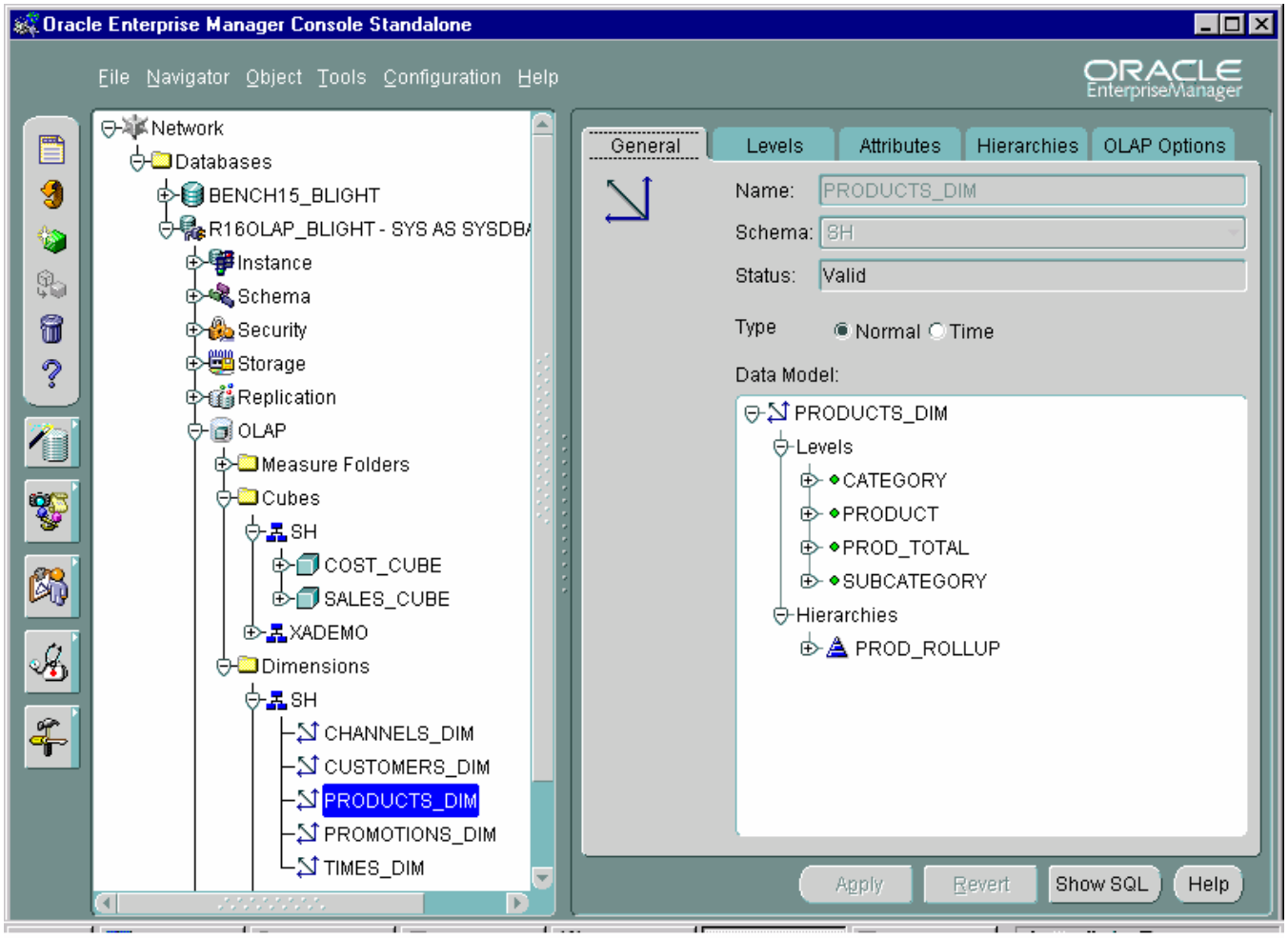
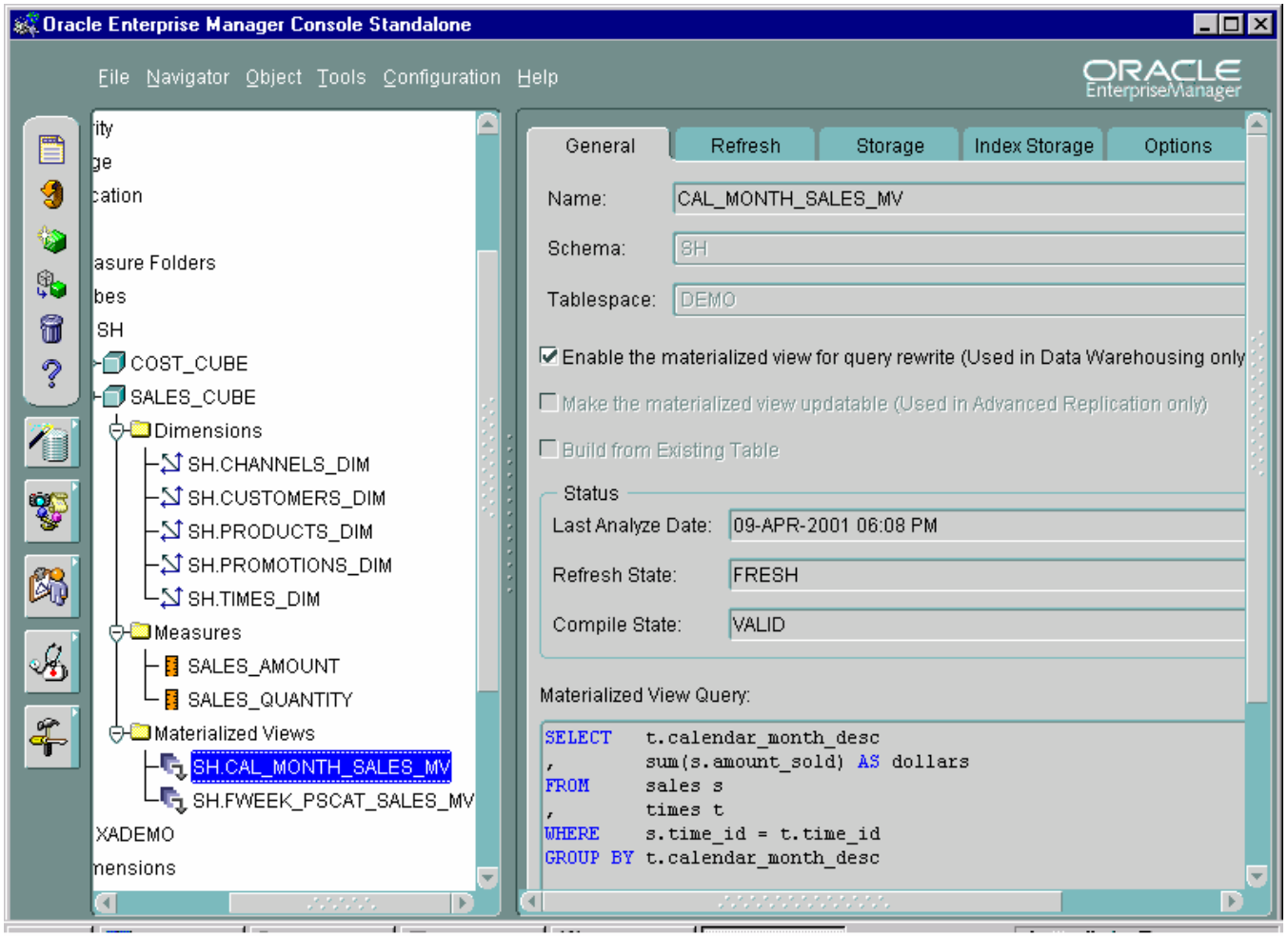
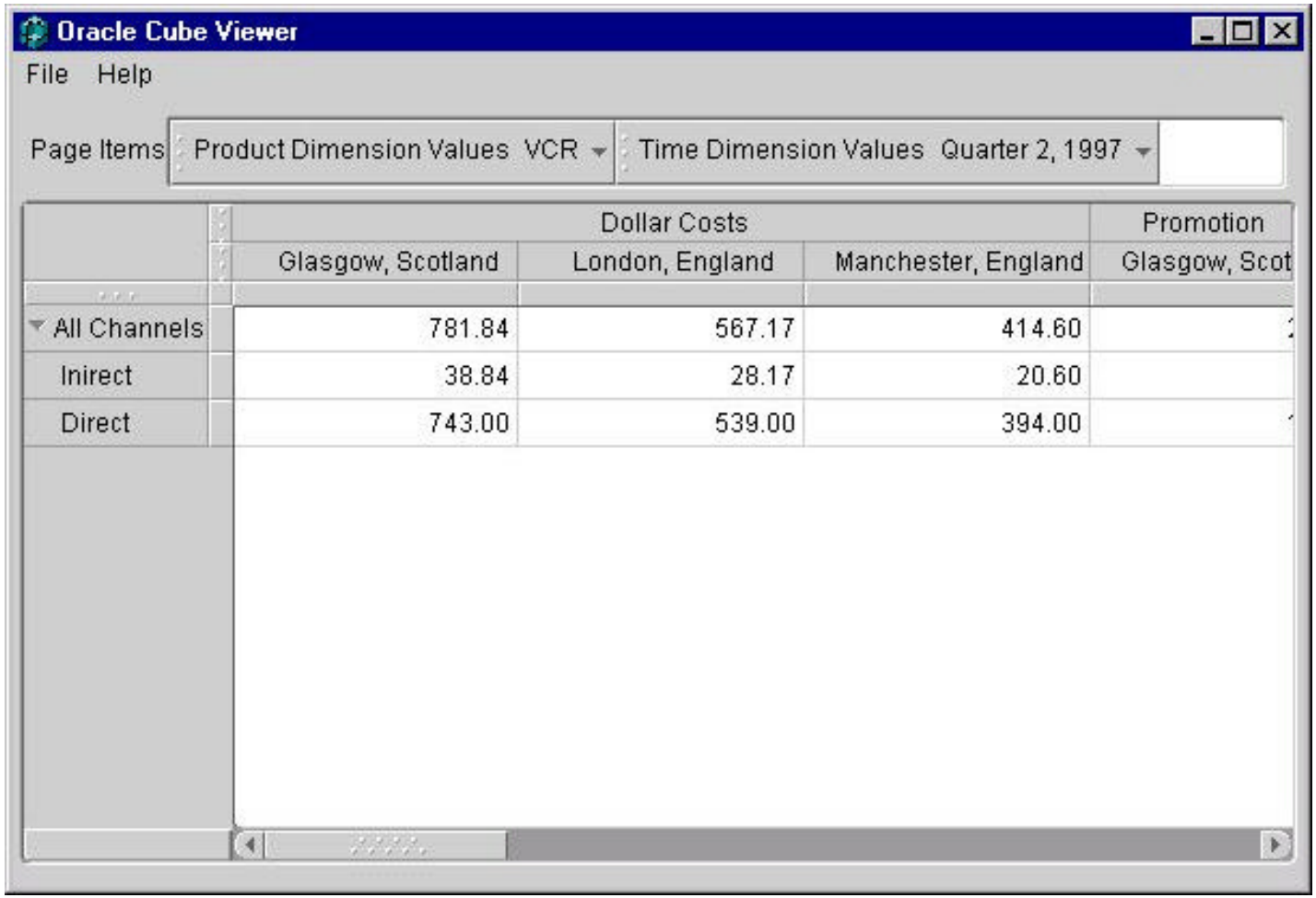
Dimension Definition



Materialized Views



Data Viewer


Oracle Cube Viewer
File Help
Page Items
Product Dimension Values VCR
Time Dimension Values Quarter 2, 1997
Dollar Costs
Promotion
Glasgow, Scotland
London, England
Manchester, England
Glasgow, Scot
All Channels
781.84
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414.60
Inirect
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20.60
Direct
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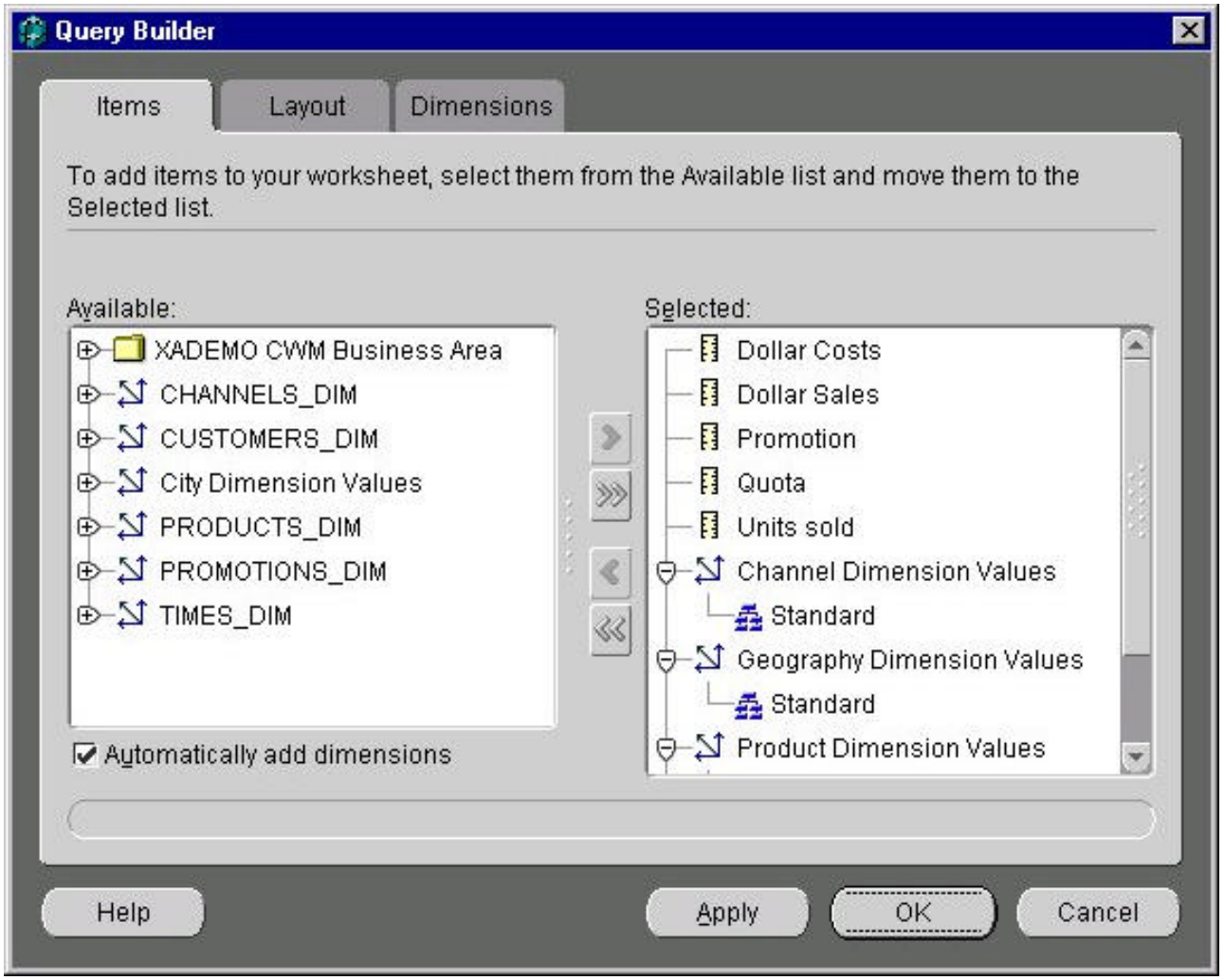
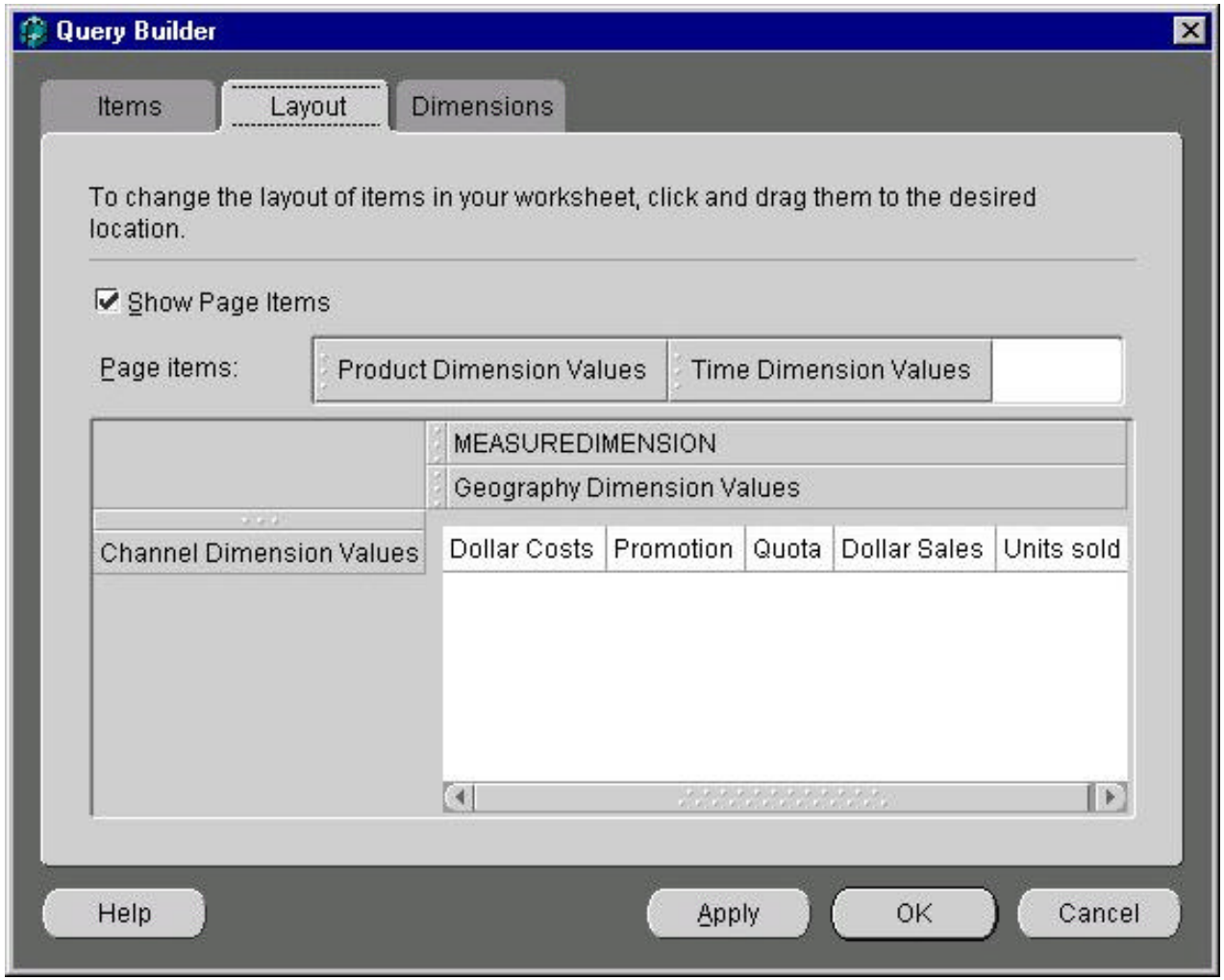
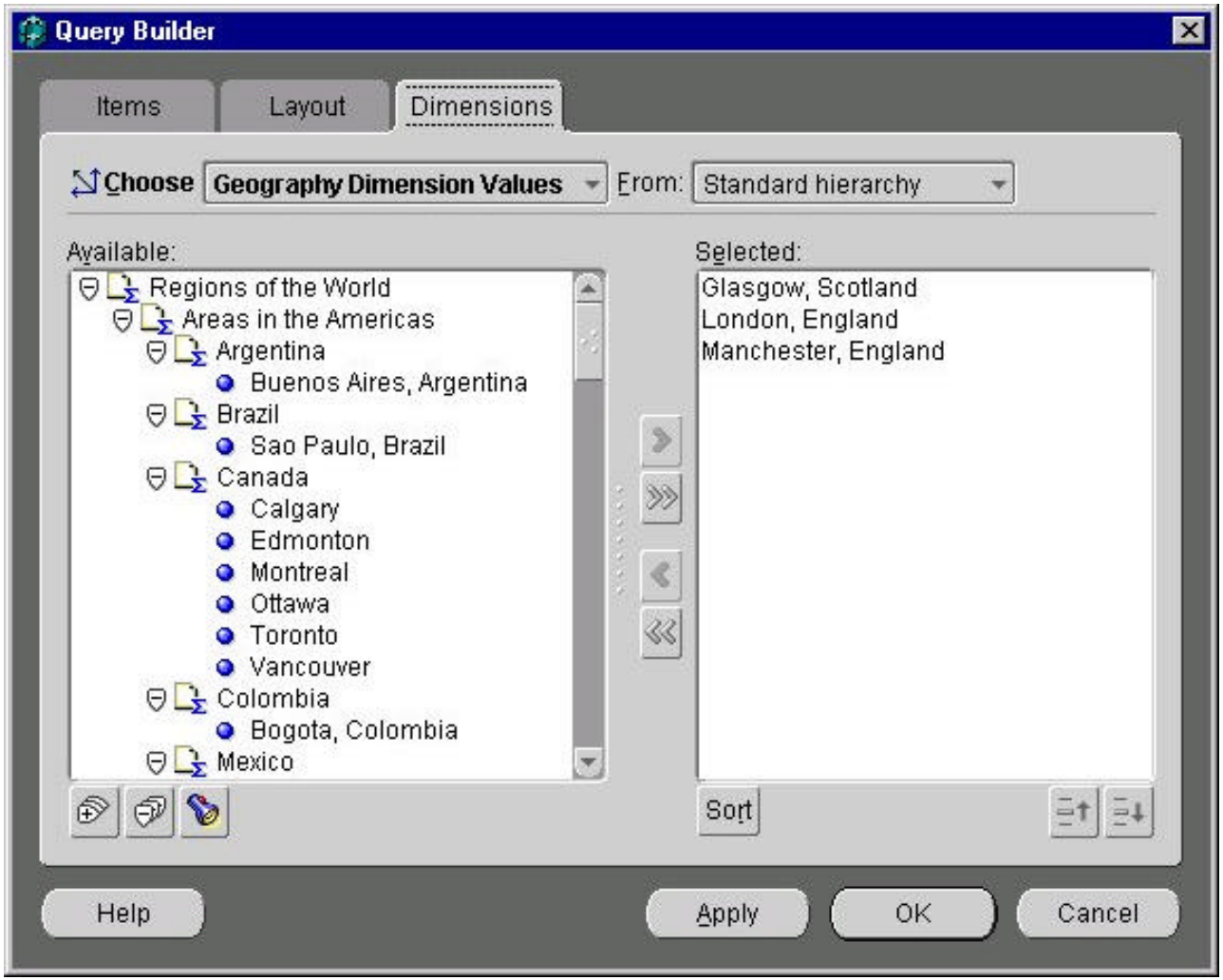
Query Builder



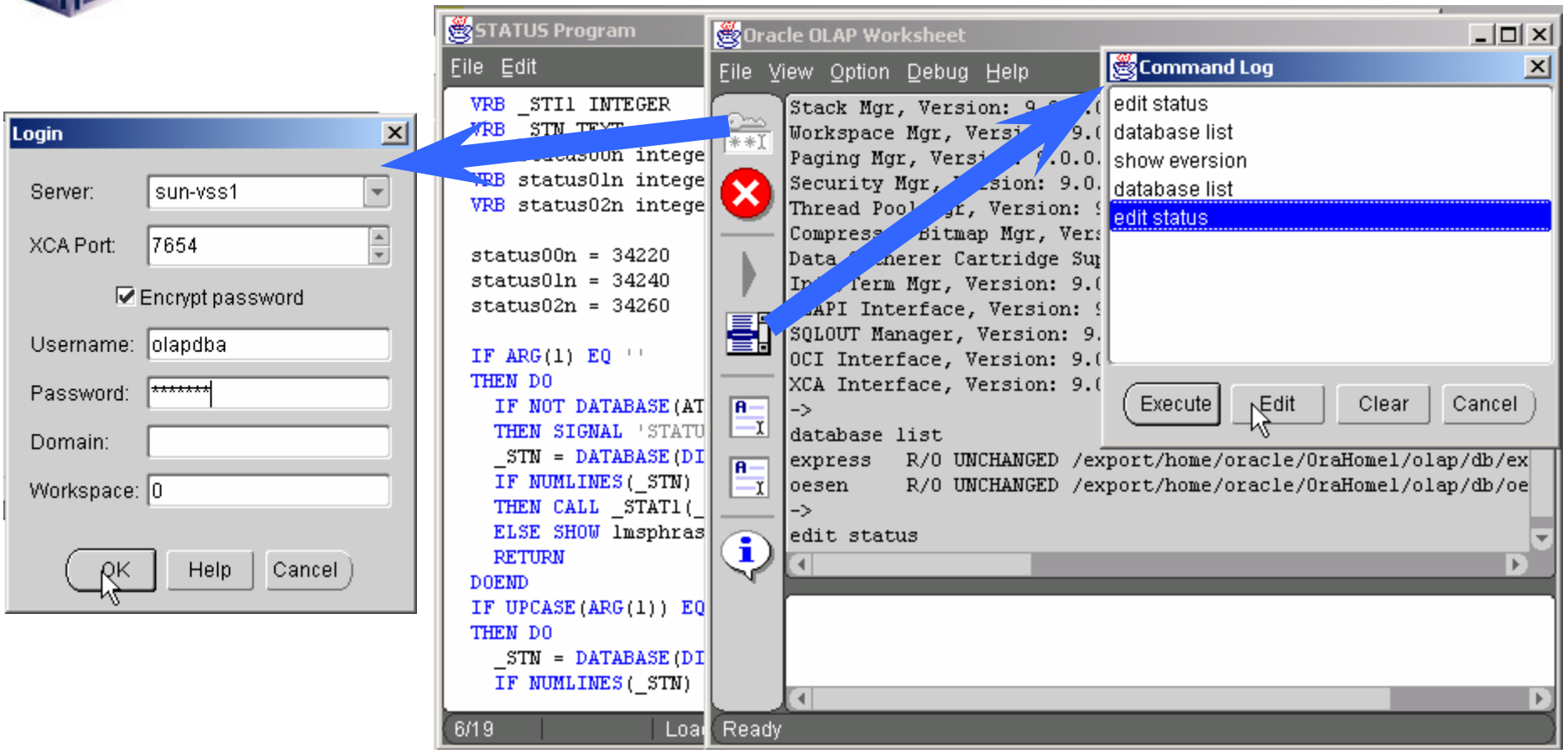
Query Builder – Layout Specification



Query Builder – Dimension Selector



OLAP Worksheet



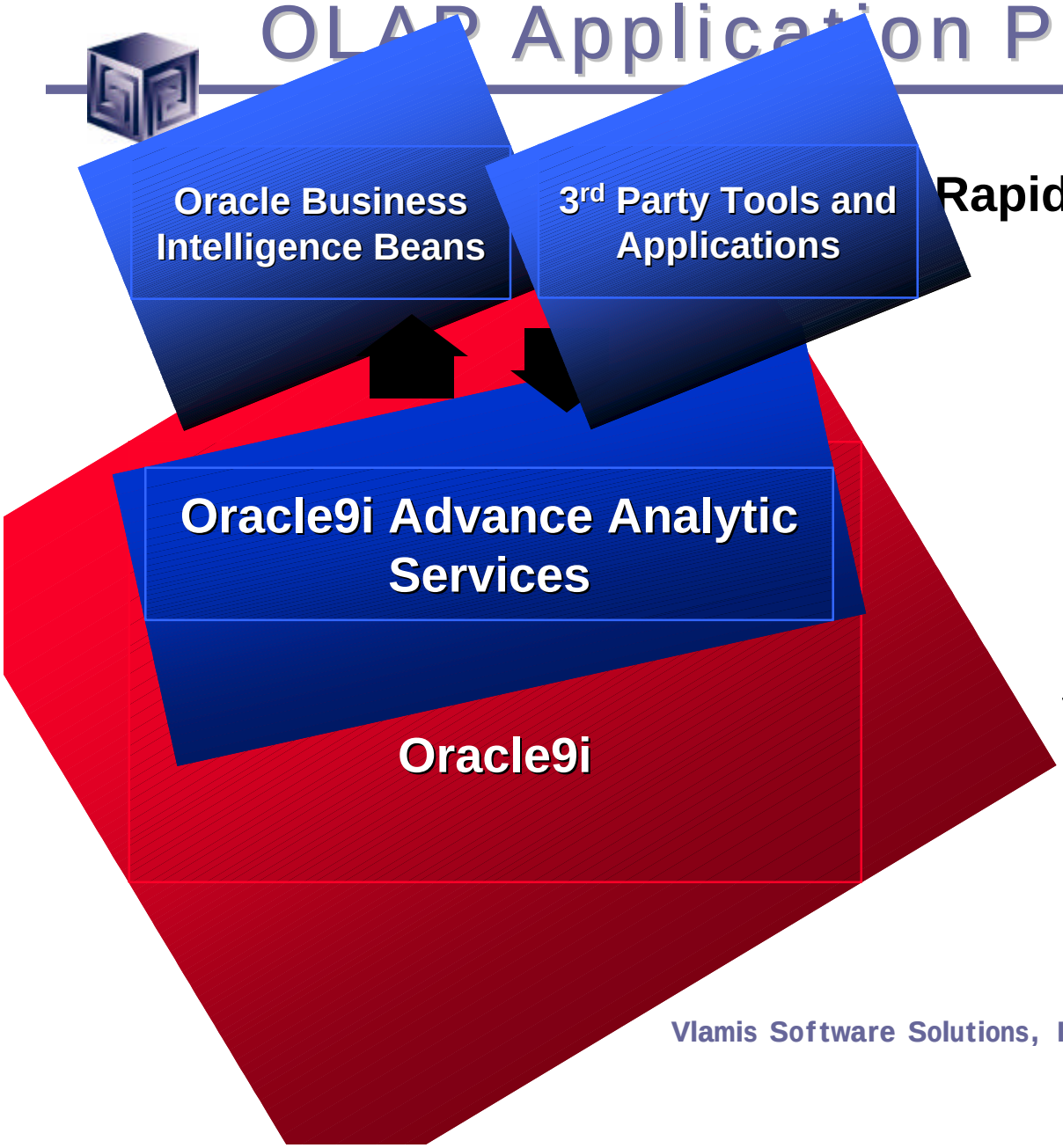
Java OLAP API

- **Designed for OLAP on the Internet**
  - **Java, object-oriented**
  - **Supports OLAP calculations**
  - **Schema independent**
- **The API for analytical tools and applications**
  - **Oracle Business Intelligence Beans**
  - **Oracle Applications**

Java OLAP API

- **Complete OLAP query API**
  - **Multidimensional object model**
  - **Statistical, mathematical, financial, and time series functions**
  - **Asymmetric queries**
  - **Calculated dimension members**
  - **Incremental query construction**
  - **Multidimensional cursors**

OLAP Application Platform



Rapid application development
Analysis ready

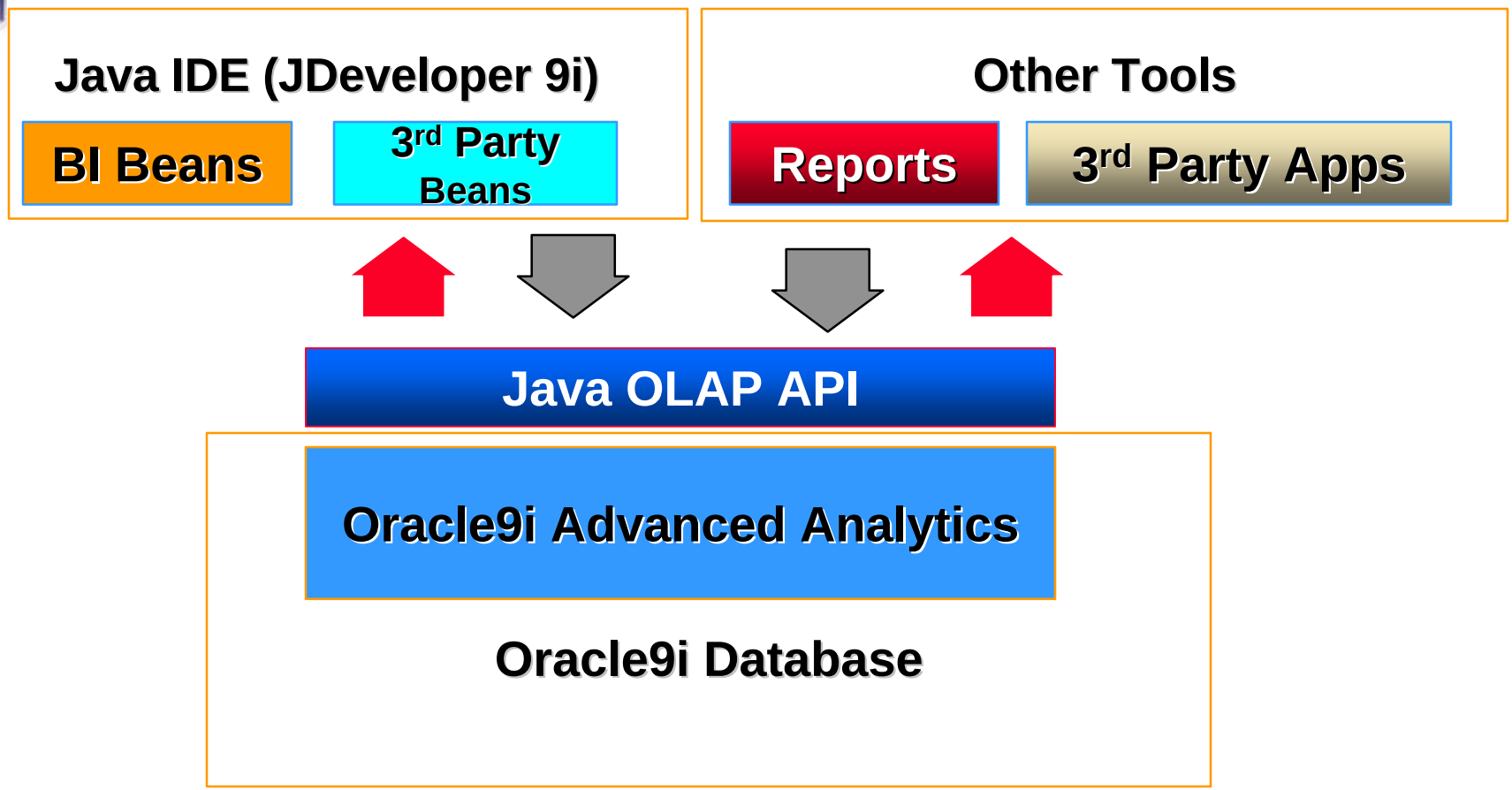
Java OLAP API

Scaleable data store
Integrated metadata

JOLAP

- **Java Extensions for OLAP**
  - **OMG Standards Group**
  - **Java v2**
  - **Oracle, Hyperion, IBM, SAS, and others**
  - **Oracle Java OLAP API to evolve to JOLAP**

OLAP Application Platform



Java Development Environment

Development

Deployment

Advanced Analytics

ORACLE®
SOFTWARE POWERS THE INTERNET™

Kevin Machos
Senior Product Manager
Analytic Tools
Oracle Corporation

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Agenda

- What are BI Beans?
- Sample Applications
- Developing Applications

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Mission

Provide the core technology platform to enable the rapid development of enterprise-wide business intelligence applications

- Advanced analytics
- Easy to use
- Easy to develop
- Facilitate collaboration
- Flexible deployment
- Scalable and performant

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JavaBeans Technology

- Component model for Java
- Self-contained pieces of software that can be assembled to form applications
- Interoperate according to a set of rules and guidelines
- Components can be pieced together programmatically or visually
- An architecture and an API

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BI Beans Java Application

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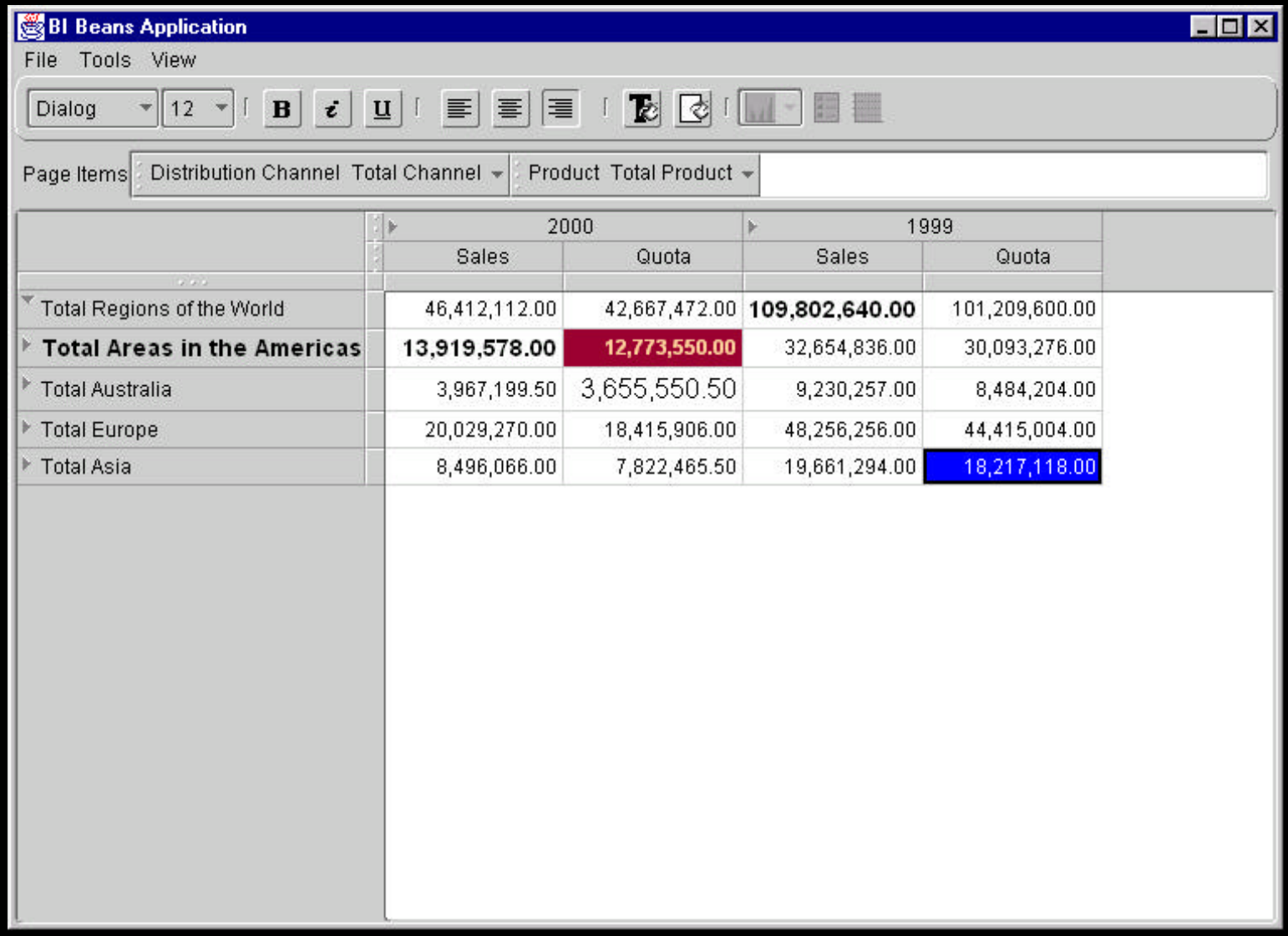

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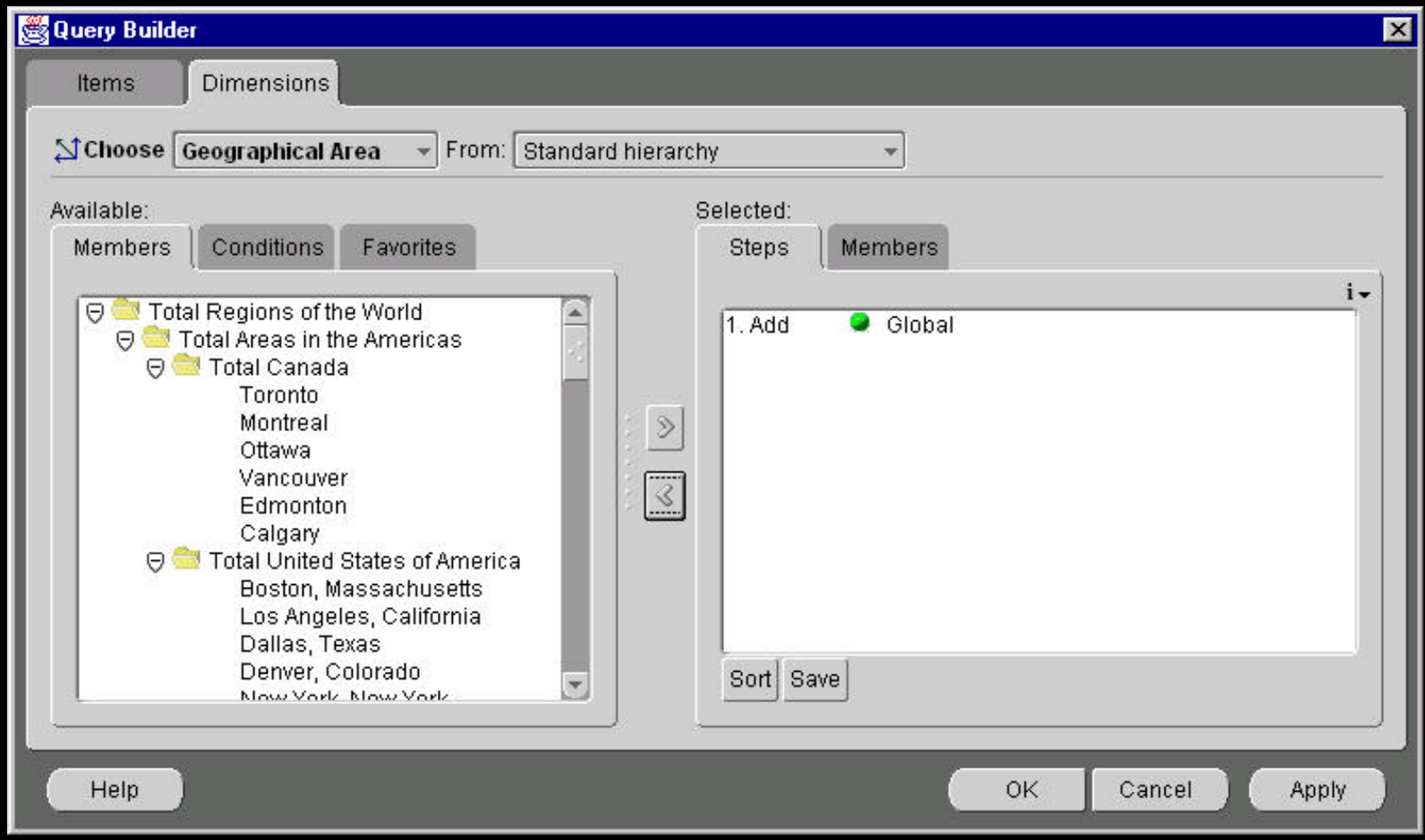

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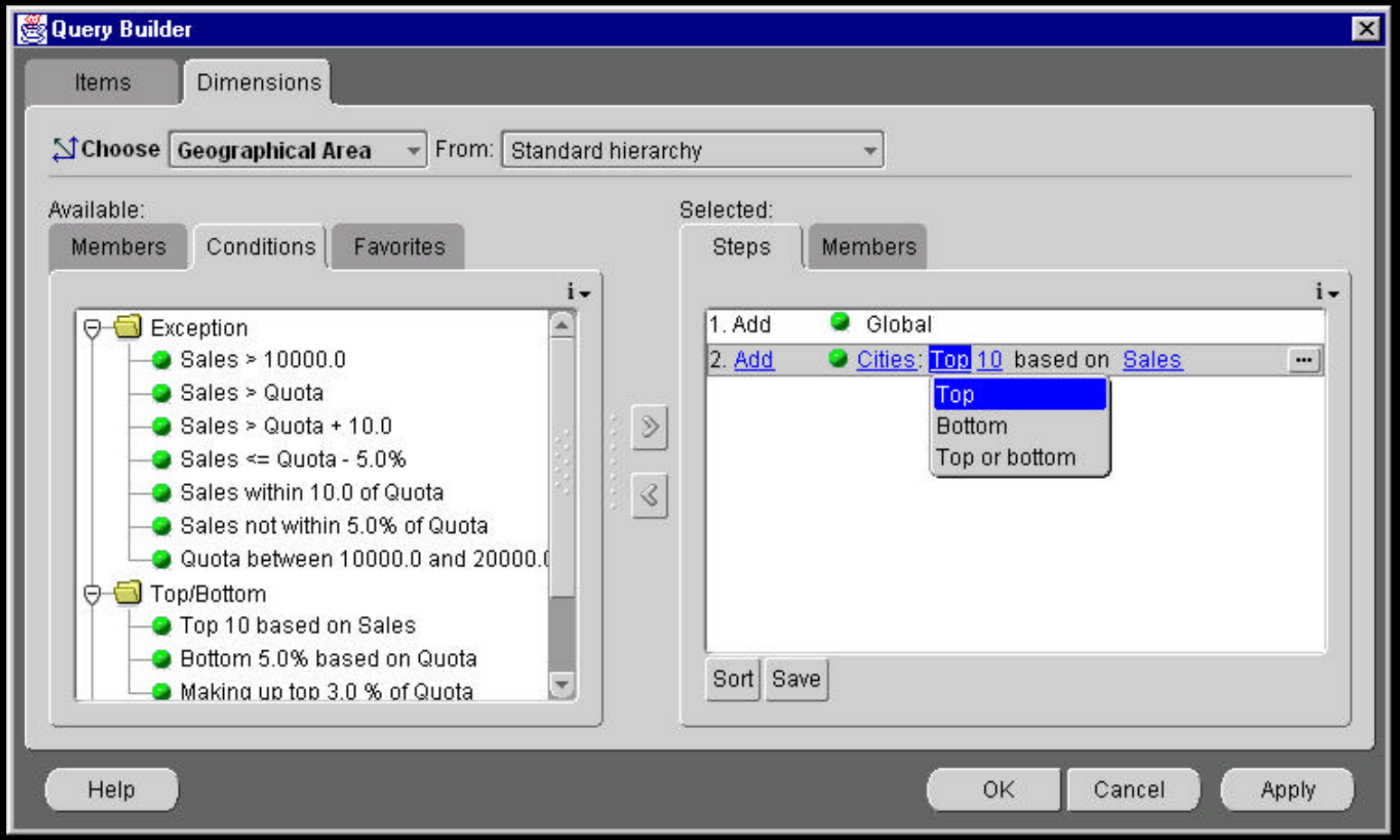

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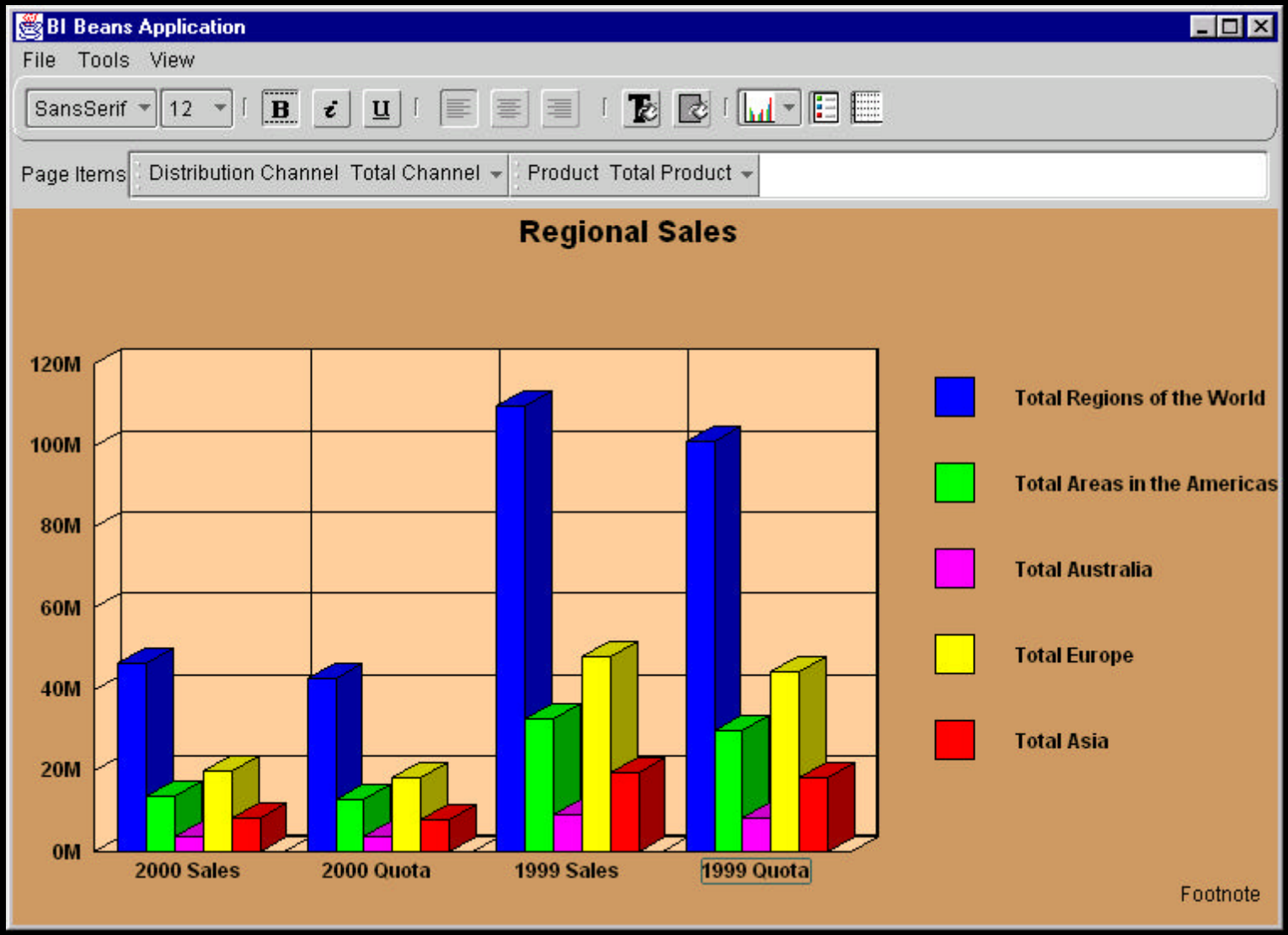

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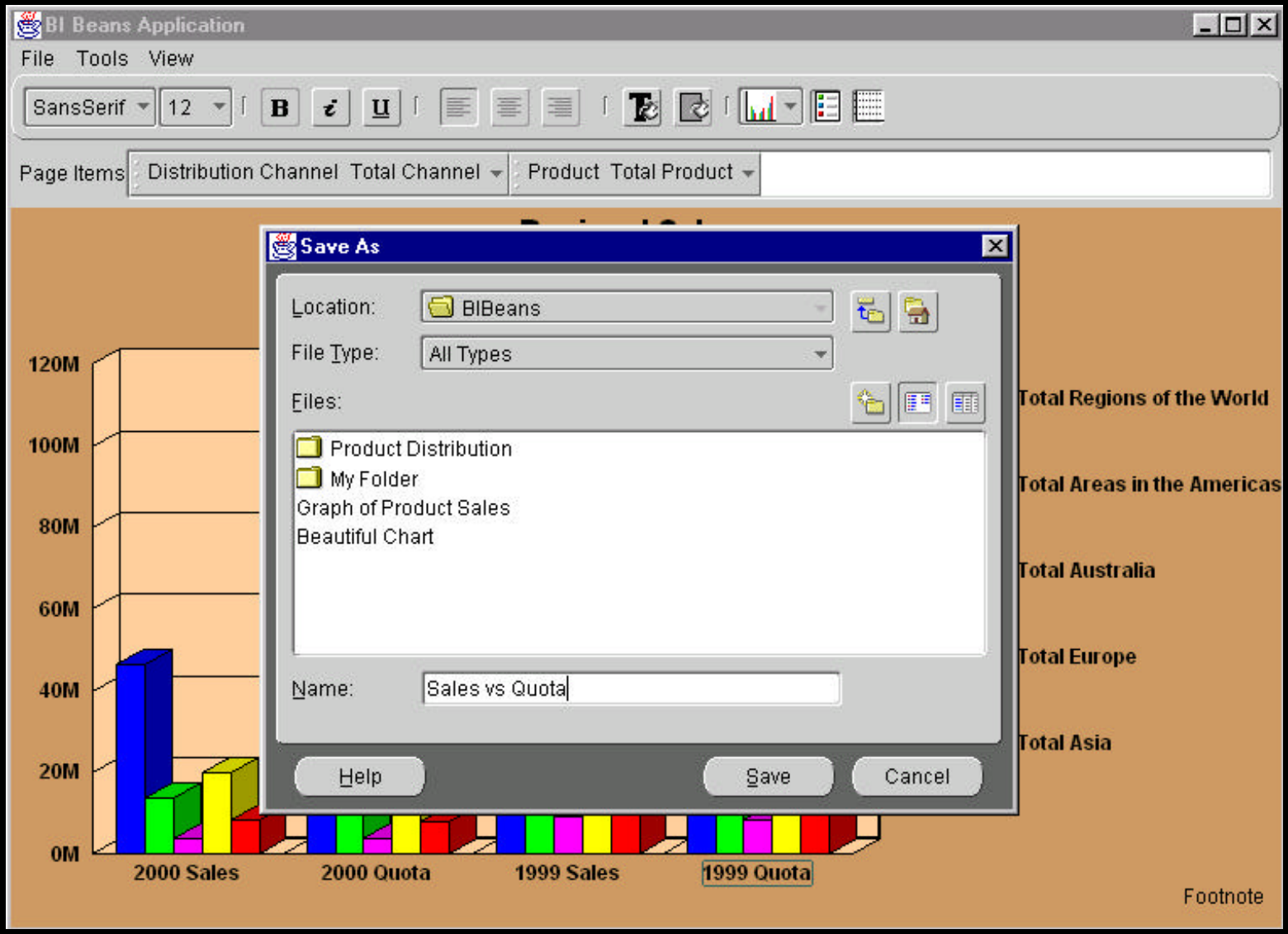

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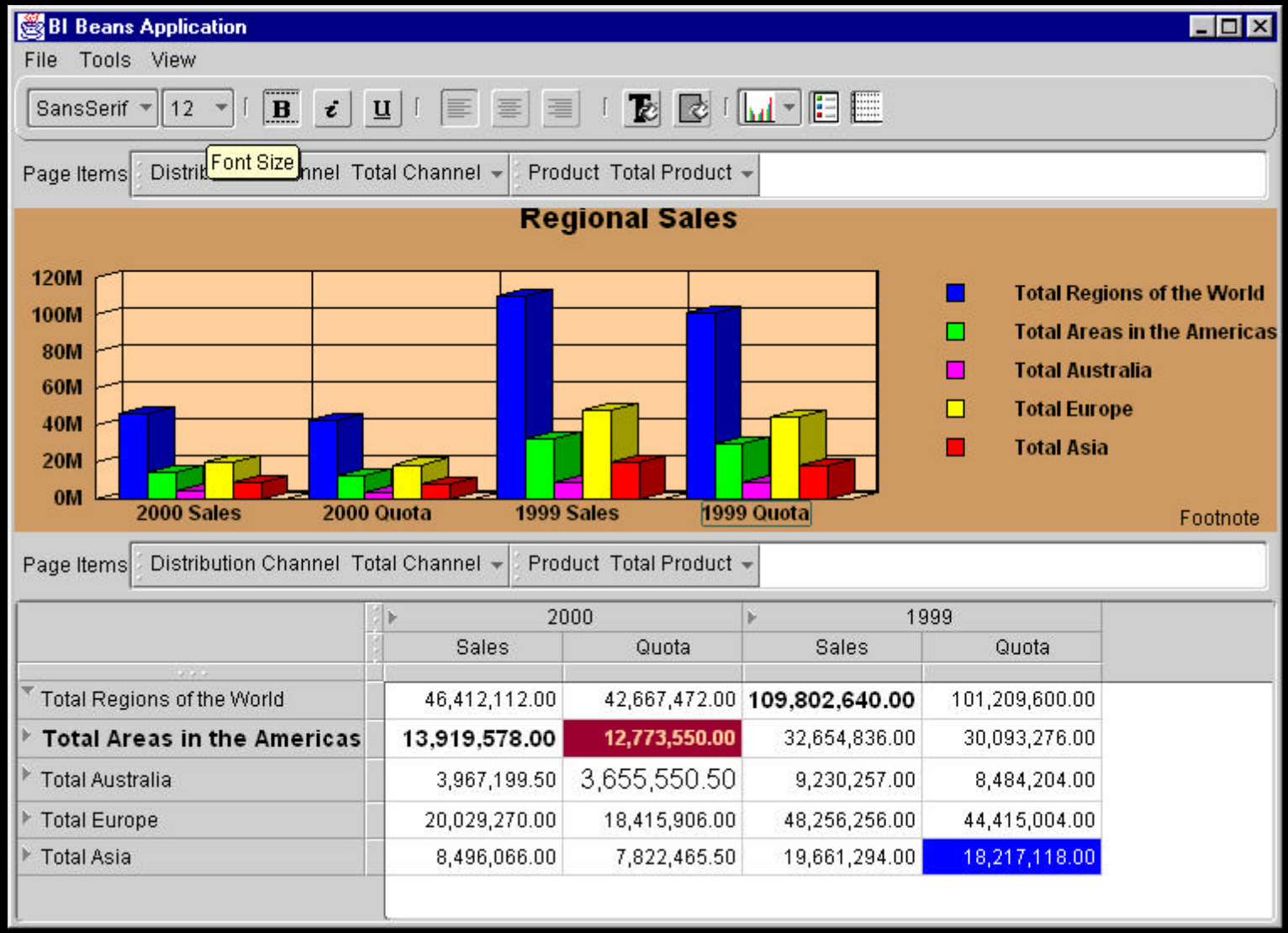

	2000		1999	
	Sales	Quota	Sales	Quota
Total Regions of the World	46,412,112.00	42,667,472.00	**109,802,640.00**	101,209,600.00
Total Areas in the Americas	**13,919,578.00**	**12,773,550.00**	32,654,836.00	30,093,276.00
Total Australia	3,967,199.50	3,655,550.50	9,230,257.00	8,484,204.00
Total Europe	20,029,270.00	18,415,906.00	48,256,256.00	44,415,004.00
Total Asia	8,496,066.00	7,822,465.50	19,661,294.00	18,217,118.00

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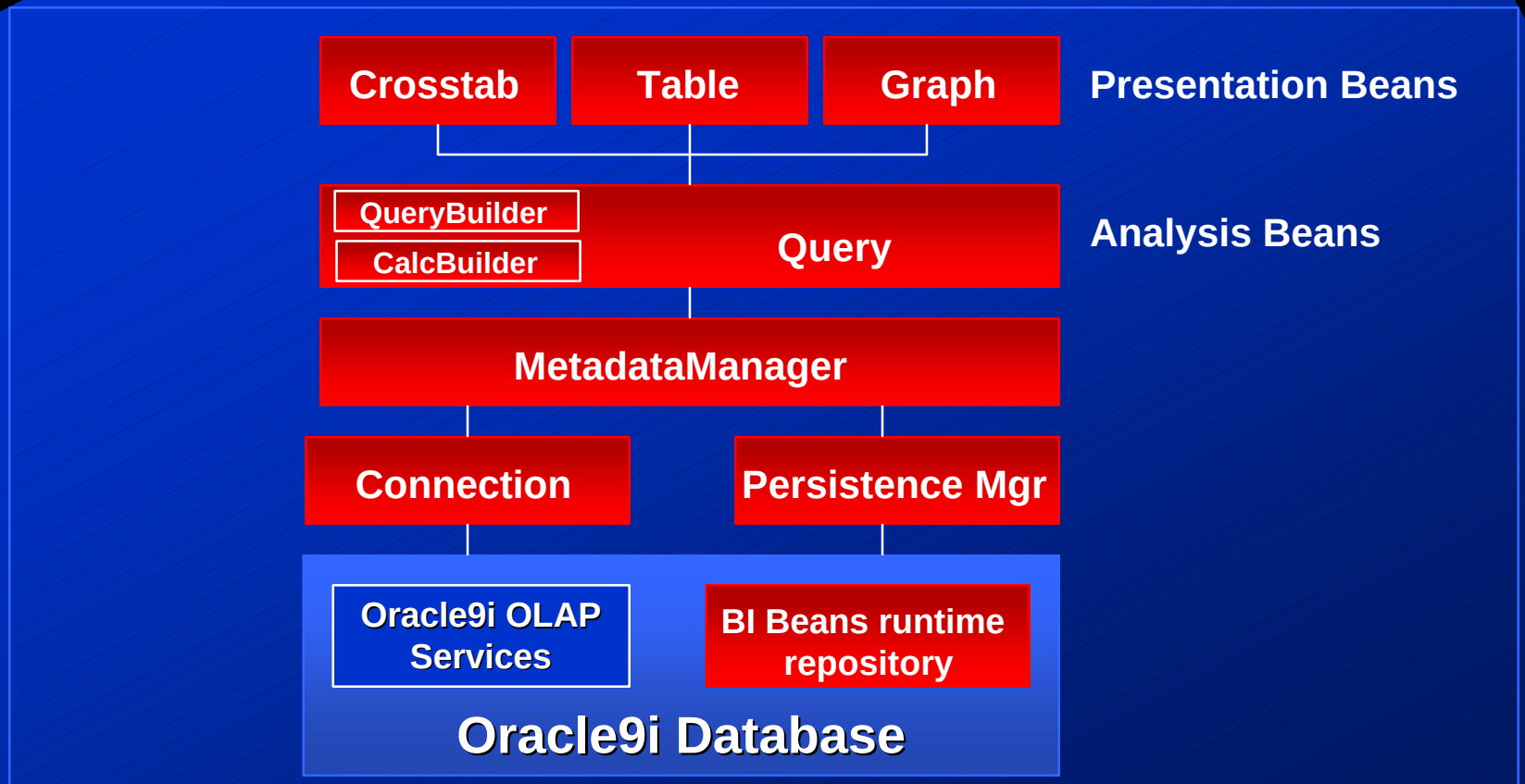
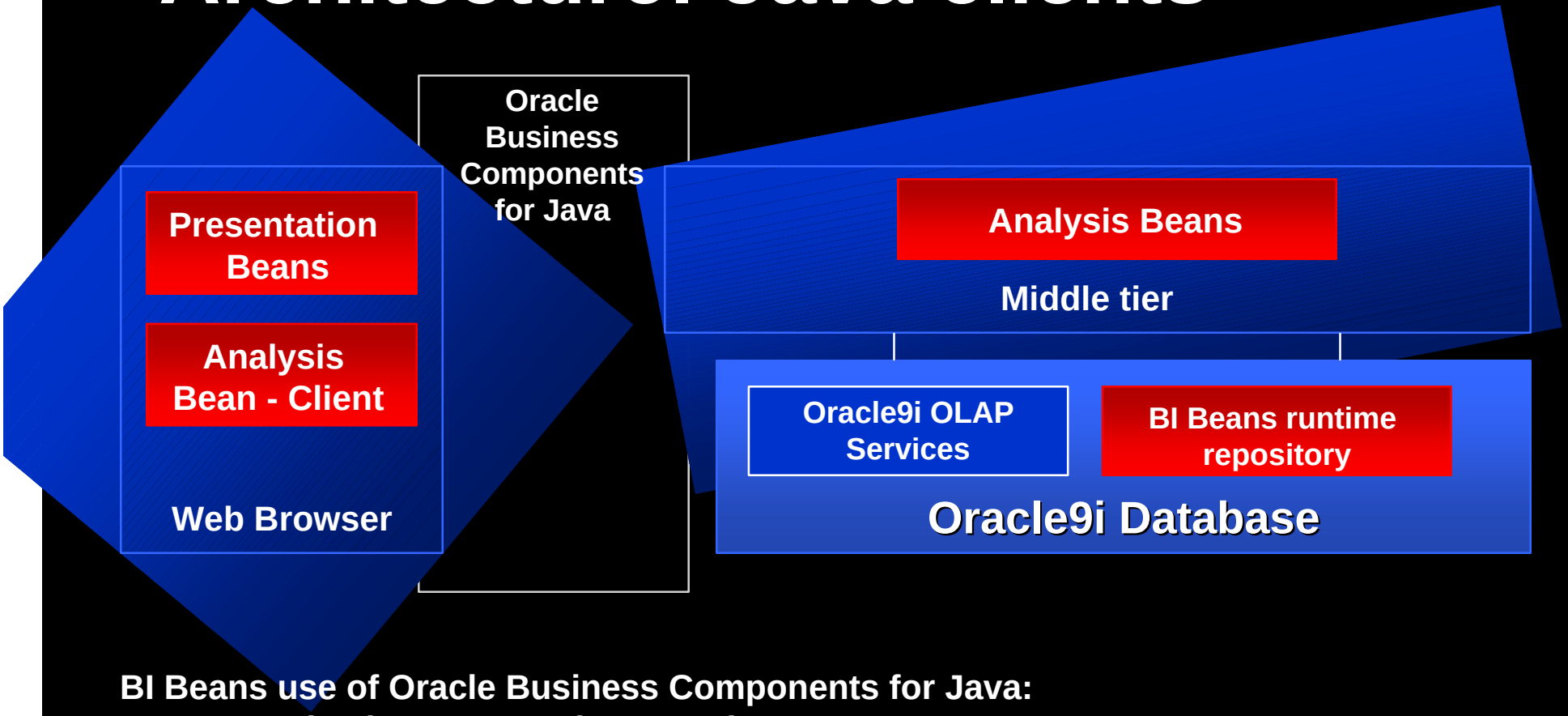
BI Beans Usage



Architecture: Java clients



BI Beans use of Oracle Business Components for Java:

* communications protocol across tiers
* deploying BI Beans on the middle tier (iAS)
* insulates application developer from “application plumbing” related to deployment

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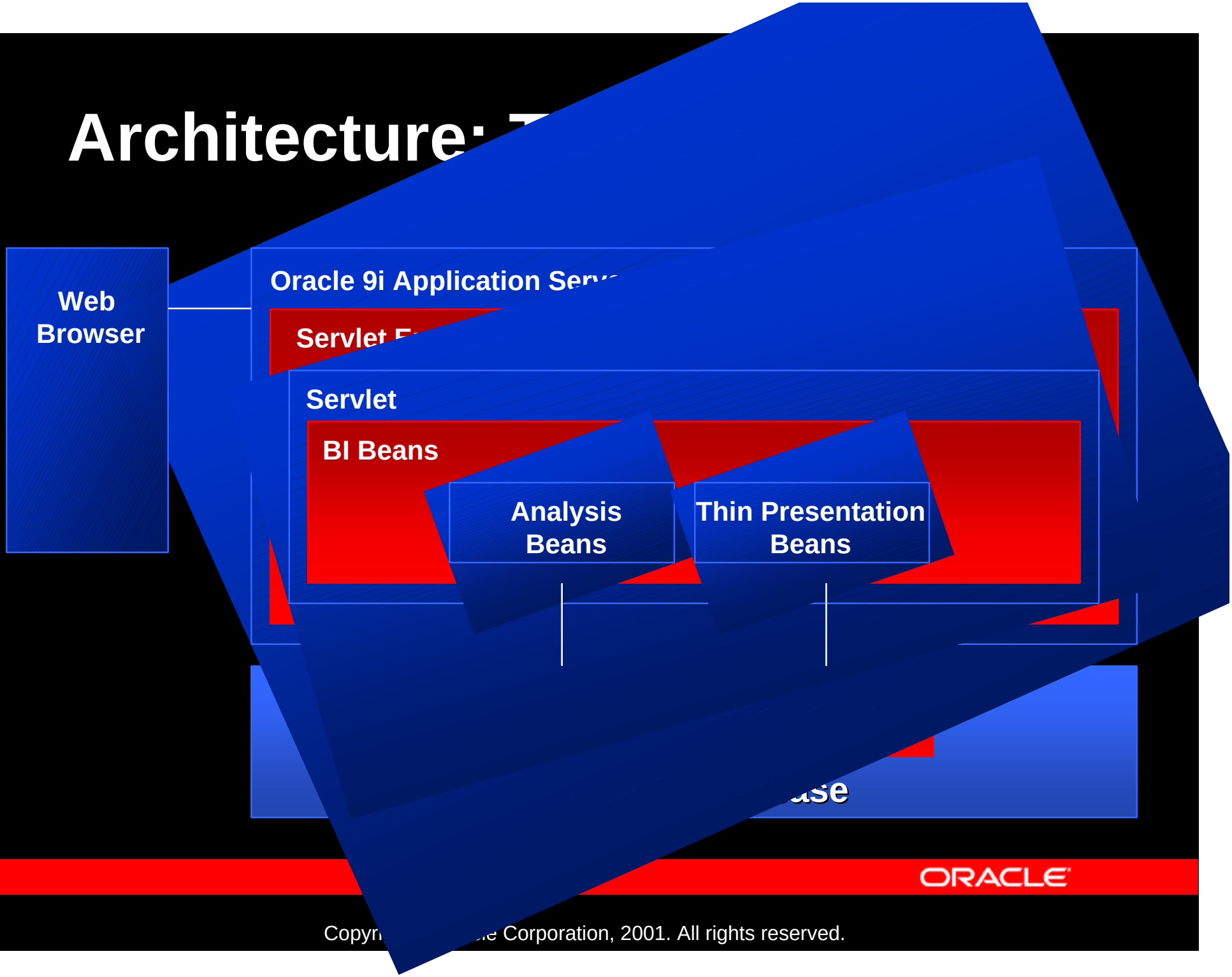
Architecture: T



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D E M O N S T R A T I O N

Thin Client

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Developing a BI Beans Application

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JDeveloper Integration

- Goal: Provide the premier tool for developing Business Intelligence applications
- Key design-time integration objectives
  - Use JDeveloper concepts; extend when necessary
  - Live data access
  - Run application objects
  - Leverage BI Beans runtime repository to enable multiple deployment options

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Two-Step Development Process

- Define application objects
  - Deployment agnostic
  - XML object definitions
  - Definitions exported to runtime repository
- Develop application code

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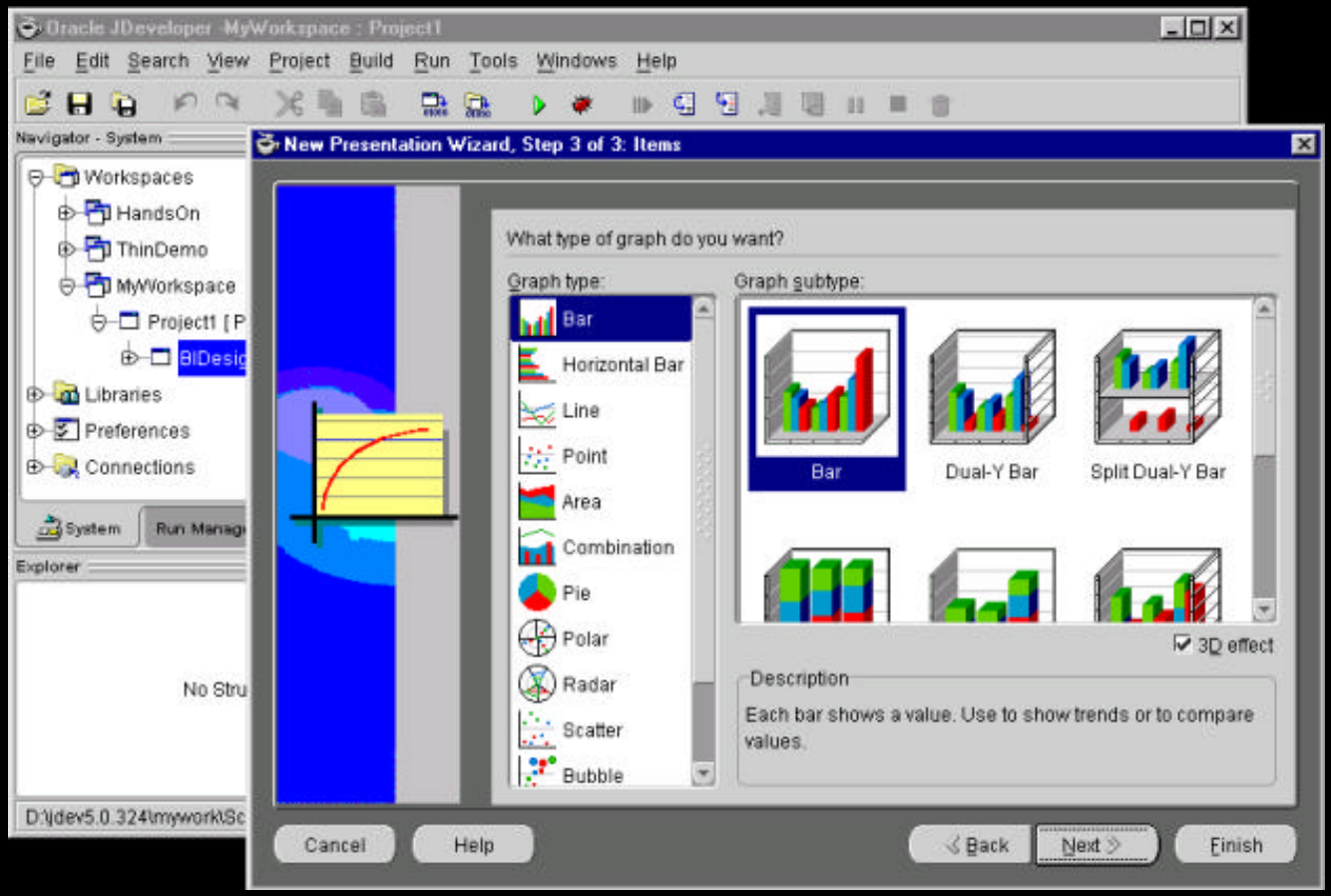
Define application objects

Wizard-driven definition of objects



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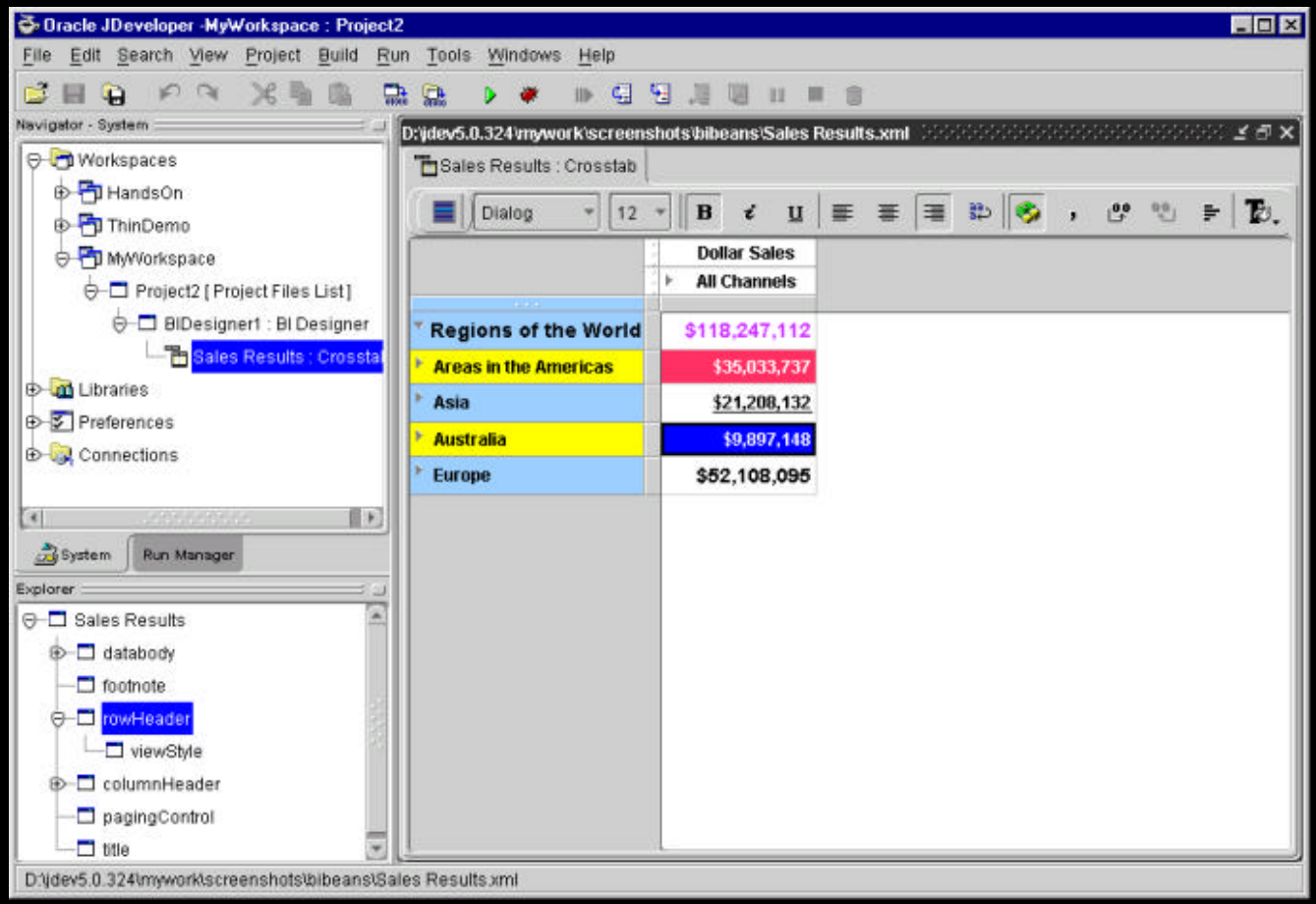
Edit application objects

Custom designers enable editing of data-aware objects



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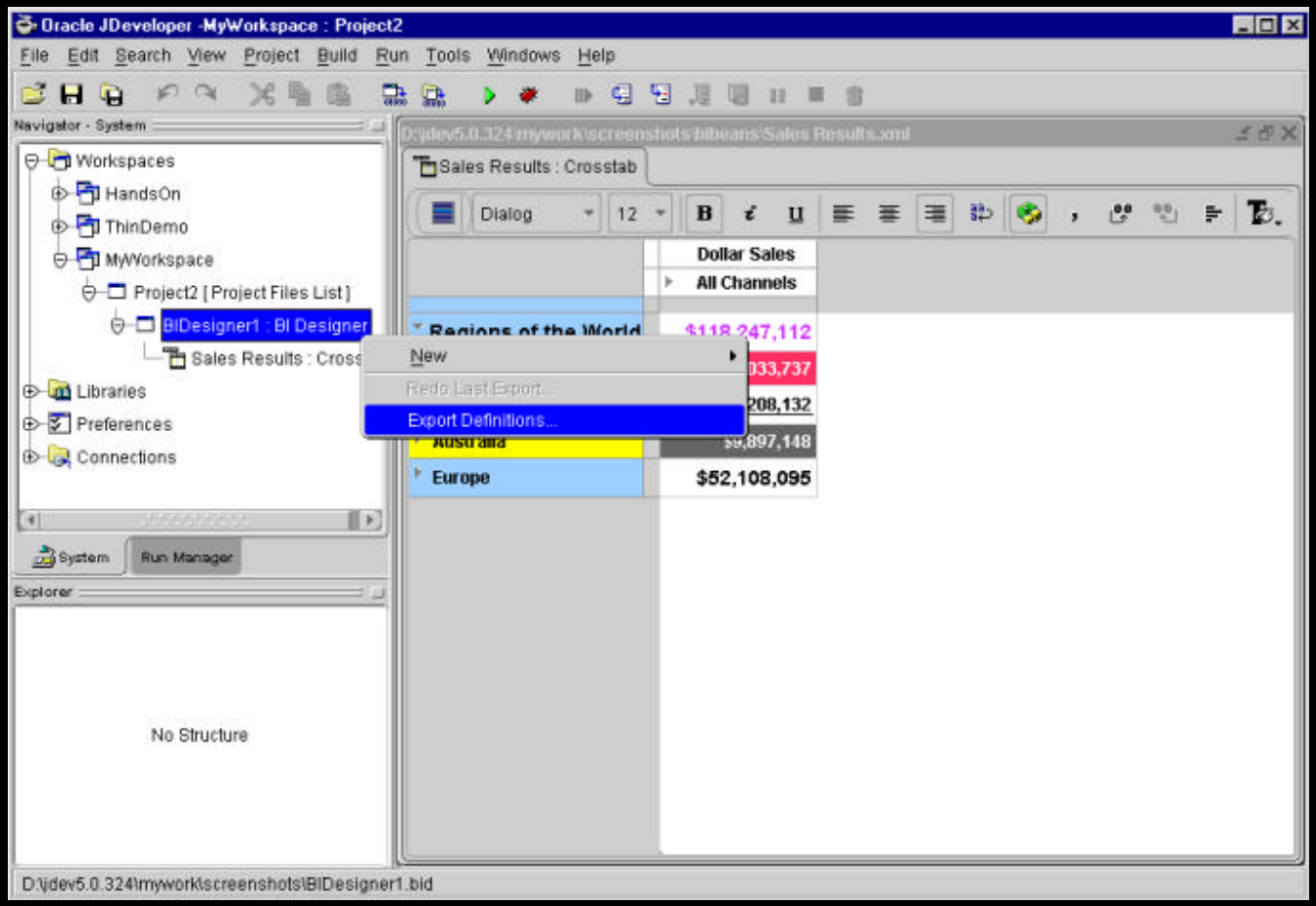
Export objects to run-time repository

Deployed objects accessible to end users



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BI Beans run-time repository

- Enables sharing of analyses across user community
  - Object definitions stored in folders
  - Access privileges specified at folder level
  - XML format
- Searchable
- Extensible

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Develop application code

- Target clients
  - Java client
  - HTML client

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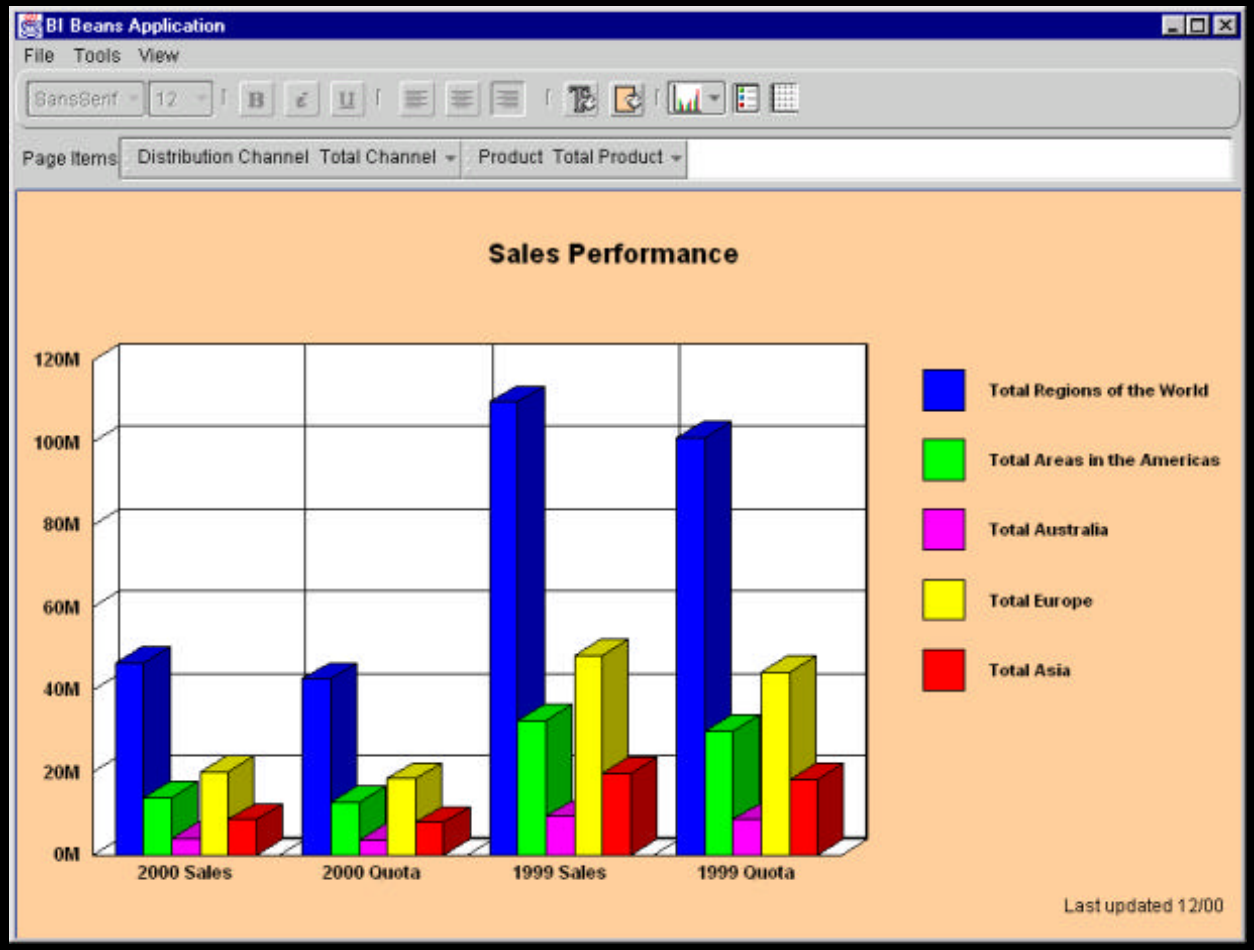
Java applet wizard

Generates basic analytical application with no coding



Open/save presentations
Define queries
Define calculations
Export to spreadsheet
Format presentations

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HTML clients: Definitions

- **Servlet**
  A Java program that extends the functionality of a Web server, generating dynamic content and interacting with Web clients using a request-response paradigm

- Java Server Pages
  Based on Servlet technology, JSPs use template data, custom elements, scripting languages, and server-side Java objects to return dynamic content to a client

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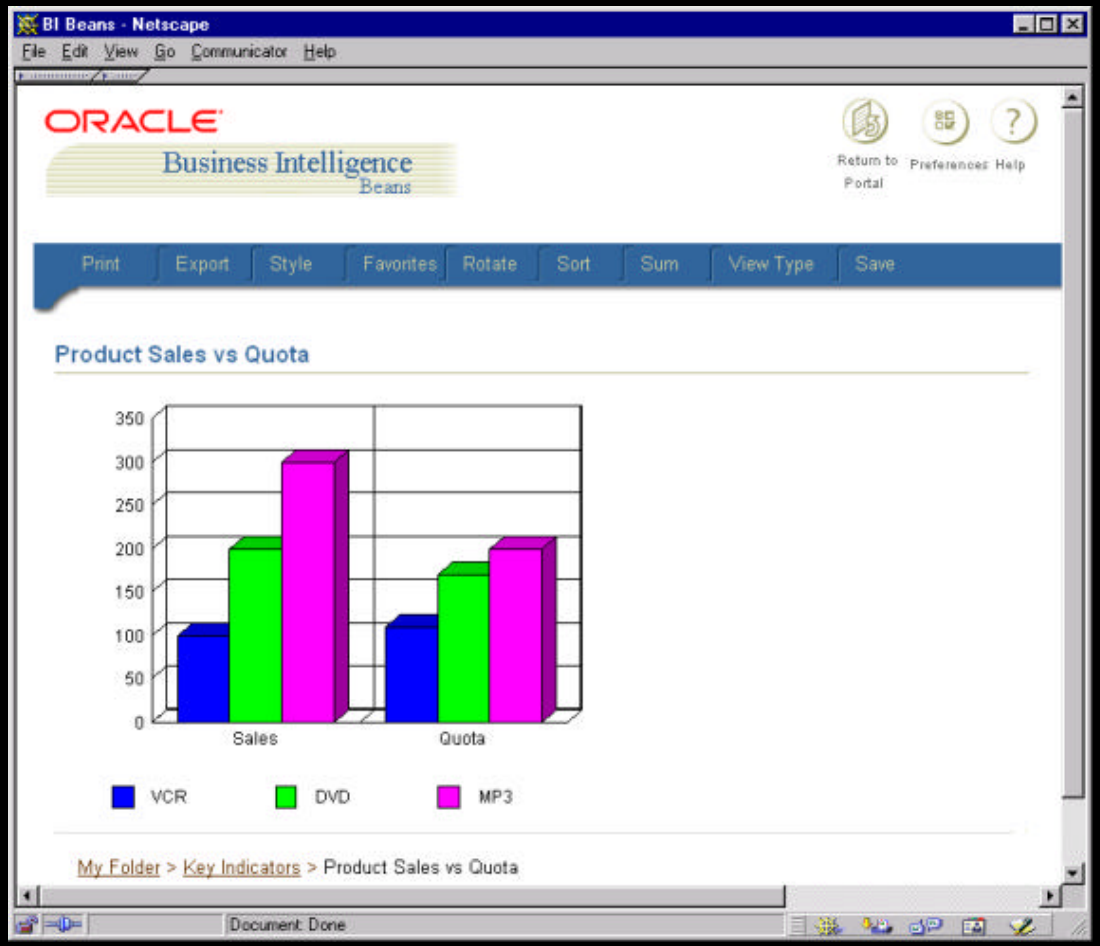
Servlet wizard

Generates simple viewer with no coding



Open/save presentations
Export to spreadsheet
Change view type
Drill/rotate
Apply favorite selections

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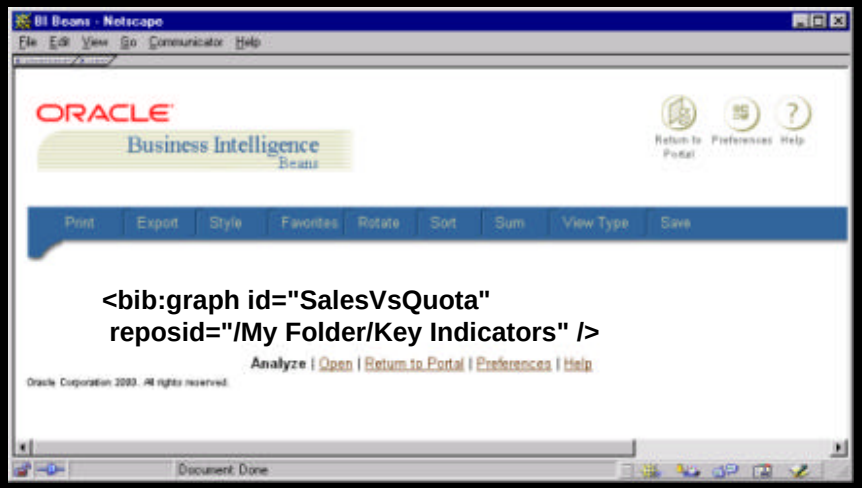
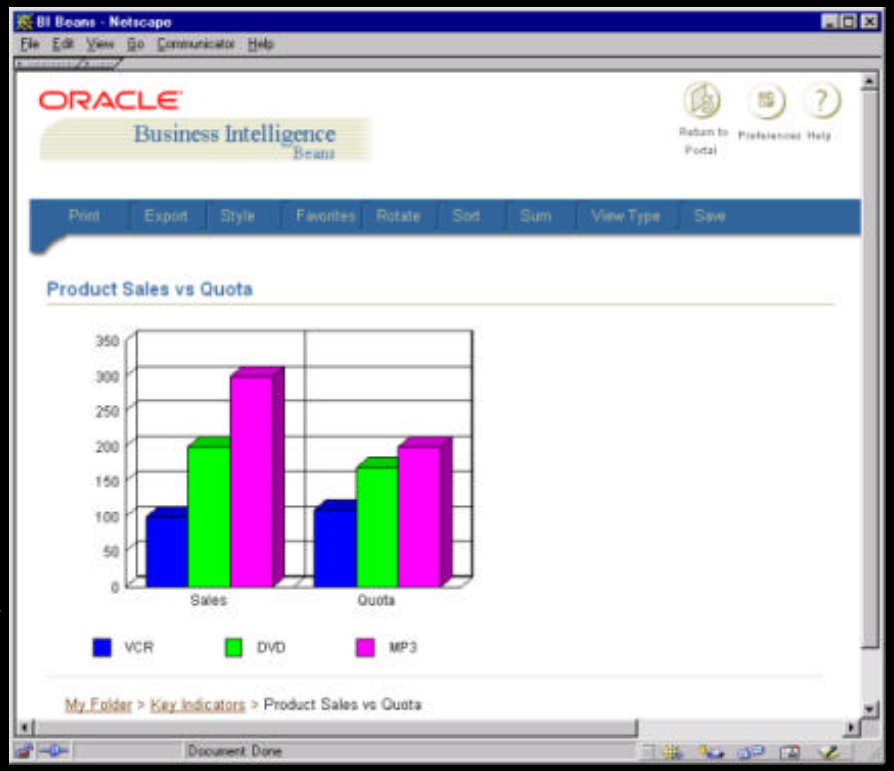
JSP Tag Libraries

- Provide simplified development through the use of reusable custom actions





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Where can you get BI Beans?

- Released with JDeveloper 9i
  - Samples on TechNet
- Used by other Oracle development groups
  - Discoverer
  - Reports
  - Enterprise Manager
  - Applications
  - Others…

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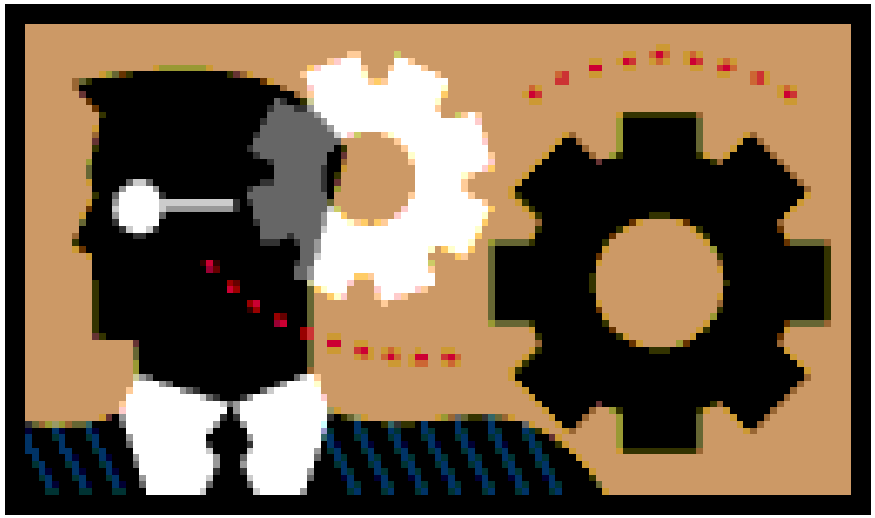
What Next?

- **Learn Oracle 9i**
  - **Learn new Analytical Functions**
  - **Build Warehouse using new features**
  - **Optionally use OWB**
- **Learn Java programming**
  - **Start with JDeveloper 3.2**
  - **Learn how to create Servlet/JSP**
- **Learn BI Beans (During Beta?)**
  - **Tutorials**
  - **Samples**
  - **Training**

QUESTIONS?



Other Presentations

IOUG-A BIG SIG

Monday, April 30, 2001 Time:4:45 PM – 5:45 PM Pelican (Swan)

465: Oracle 9i OLAP Services and Express -- What Now?
Dan Vlamis, Vlamis Software Solutions, Inc.

Tuesday, May 1, 2001 Time:1:30 PM - 3:00 PM

418: Business Intelligence Portals and Oracle Portal
Elizabeth Reardon, Vlamis Software Solution, Inc.

Tuesday, May 1, 2001Time:9:30 AM - 10:30 AM

476: Oracle9i for e-business: Business Intelligence
John Haydu, Oracle Corporation

Wednesday, May 2, 2001 Time:9:30 AM - 10:30 AM

278: Oracle's SQL Analytic Functions in 8i and 9i

David Fuston, Vlamis Software Solutions, Inc.
Thursday, May 3, 2001 Time:9:30 AM - 10:30 AM

477: Oracle9i OLAP A Scalable Web-Based Business Intelligence Platform

Bud Endress, Oracle Corporation

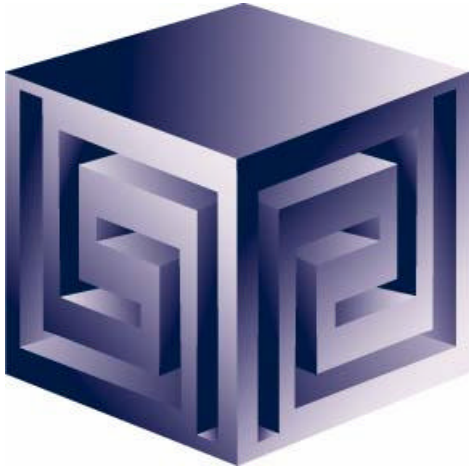
Thursday, May 3, 2001 Time:11:00 AM - 12:00 PM

OLAP Applications, BIBeans, And Java OLAP API

presented at

IOUG-A Live! 2001

paper number 401



Presented by:

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http://www.vlamis.com

Kevin Machos (kevin.machos@oracle.com)

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